

19.3.1.2

**STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS**  
**FOR THE**  
**CONSTRUCTION**  
**OF**  
**ON-SITE CONTAINMENT FACILITY**

Commencement Bay Nearshore/Tideflats Superfund Site  
Operable Unit 02 - Asarco Tacoma Smelter Facility and Slag Peninsula  
Ruston and Tacoma, Washington

RECEIVED  
APR - 4 2000  
Environmental Cleanup Office

Prepared for:

Mr. Thomas L. Aldrich  
Site Manager  
**ASARCO Incorporated**  
P.O. Box 1677  
Tacoma, WA 98402

Prepared by:

**Hydrometrics, Inc.**  
5219 North Shirley  
Suite 100  
Ruston, WA 98407



EXPIRES 10/06/01

(Revised Issue Date: February 2000)

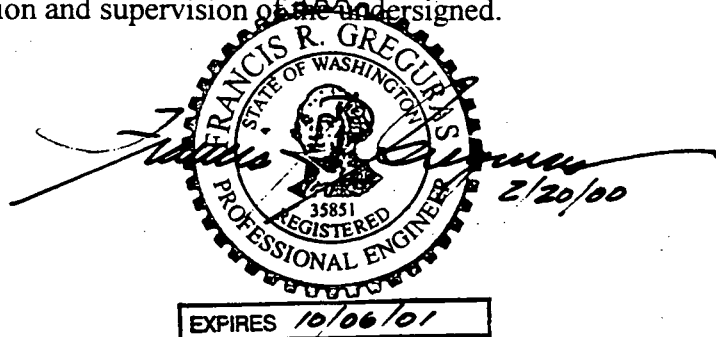
**Control #**  
**009**

USEPA SF



1115692

Special Provisions Division 1,2,5,7,8, and 9 Sections 9-05 through 9-39 were prepared under the direction and supervision of the undersigned.



Francis R. Greguras,  
Hydrometrics, Inc.

Date

## Asarco Landfill Leachate Collection System

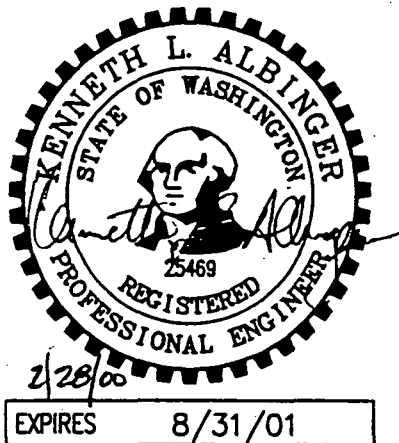
JOB #J.N. 99071.301

DATE: FEBRUARY 16, 1999

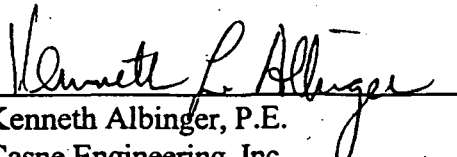
### ELECTRICAL SPECIFICATION

<u>SECTION</u>	<u>DESCRIPTION</u>
9-40	GENERAL
9-41	OVERCURRENT PROTECTIVE DEVICES
9-42	SERVICE AND METERING
9-43	PANELBOARDS
9-44	ALARM PANEL & STARTER

All the above sections of technical specifications have been prepared by or under our direct supervision.



Special Provisions Division 9, Sections 9-40 through 9-44 related to electrical specifications were prepared under the direction and supervision of the undersigned.

  
Kenneth Albinger, P.E.  
Casne Engineering, Inc.

2/28/00  
Date



## STANDARD SPECIFICATIONS

The 1998 Standard Specifications for Road, Bridge and Municipal Construction, prepared by the Washington State Department of Transportation and the American Public Works Association, Washington State Chapter, as modified by the 1998 APWA Amendments to Division One and the 1998 City of Tacoma Amendments, hereinafter called the Standard Specifications are the construction specifications for this project.

Standard Specifications are modified by Special Provisions as detailed in the following divisions. Division and subdivision numbers refer to corresponding numbers of the Standard Specifications.

## TABLE OF CONTENTS

### SPECIAL PROVISIONS

DIVISION 1	GENERAL REQUIREMENTS-----	1-1
DIVISION 2	EARTHWORK -----	2-1
DIVISION 5	SURFACE TREATMENTS AND PAVEMENTS -----	5-1
DIVISION 7	DRAINAGE STRUCTURES, STORM SEWERS, SANITARY SEWERS, WATER MAINS, AND CONDUITS -----	7-1
DIVISION 8	MISCELLANEOUS CONSTRUCTION-----	8-1
DIVISION 9	MATERIALS-----	9-1

**DIVISION 1  
GENERAL REQUIREMENTS**

**1-01 DEFINITIONS AND TERMS**

**1-01.1 General**

The following abbreviations and terms are defined here as they are used in any contract documents and specifications. When used in the proposal form to denote items of work and units of measurements, abbreviations are defined to mean the full expression.

**1-01.2 Abbreviations**

**1-01.2(1) Associations and Miscellaneous**

These abbreviations are used in plans and specifications as defined here:

AAA	American Arbitration Association
AAN	American Association of Nurserymen
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AGA	American Gas Association
AGC	Associated General Contractors of America
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMSL	Above mean sea level
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ARA	American Railway Association
AREA	American Railway Engineering Association
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASLA	American Society of Landscape Architects
ASME	American Society of Mechanical Engineers
ASNT	American Society for Nondestructive Testing
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
CFR	Code of Federal Regulations
CLI	Chain Link Institute
CP&D	Comprehensive Plans and Documents
CRAB	County Road Administration Board
CRSI	Concrete Reinforcing Steel Institute
DIPRA	Ductile Iron Pipe Research Association
EEl	Edison Electric Institute
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
FSS	Federal Specifications and Standards, General Services Administration
FTMS	Federal Test Method Standard
HUD	United States Department of Housing and Urban Development
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
IES	Illumination Engineering Society
IMSA	International Municipal Signal Association
LID	Local Improvement District
LPI	Lighting Protection Institute
MDP	Master Development Plan

MSHA	Mine Safety and Health Act
MUTCD	Manual on Uniform Traffic Control Devices
NEC	National Electrical Code
NEMA	National Electrical Manufacturers' Association
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NRMCA	National Ready Mix Concrete Association
OCF	On-site Containment Facility
OMWBE	Office of Minority and Women's Business Enterprises
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PPI	Plastic Pipe Institute
P/PCI	Precast/Prestressed Concrete Institute
RCW	Revised Code of Washington (Laws of the State)
RID	Road Improvement District
SAE	Society of Automotive Engineers
SEPA	State Environmental Policy Act
SSPC	Steel Structures Painting Council
TIB	Transportation Improvement Board
UL	Underwriter Laboratory
ULID	Utility Local Improvement District
UMTA	Urban Mass Transit Administration
WAC	Washington Administrative Code
WCLIB	West Coast Lumber Inspection Bureau
WISHA	Washington Industrial Safety and Health Administration
WRI	Wire Reinforcement Institute
WSDOE	Washington State Department of Ecology
WSDOT	Washington State Department of Transportation
WWPA	Western Wood Products Association

#### 1-01.2(2) Items of Work and Units of Measurement

Plans and specifications may include common engineering and construction abbreviations. Many such abbreviations need no definition. But when the following abbreviations are used, they will only mean:

ACP	Asphalt Concrete Pavement
Agg.	Aggregate
Al.	Aluminum
ATB	Asphalt Treated Base
BST	Bituminous Surface Treatment
Cl.	Class
Cfm	Cubic Feet per Minute
Cfs	Cubic Feet per Second
Comb.	Combination
Conc.	Concrete
Crib.	Cribbing
Culv.	Culvert
cy or cu yd.	Cubic Yard
Diam.	Diameter
Est.	Estimate or Estimated
Excl.	Excluding
F	Fahrenheit
Gph	Gallon per Hour
Gpm	Gallon per Minute
Hund.	Hundred
In.	Inch
Incl.	Including
Lb	Pound(s)
LF or Lin. Ft.	Linear Foot (Feet)
LS	Lump Sum
M	Thousand
MBM	Thousand Feet Board Measure
Pres.	Pressure

PSI	Pounds per Square Inch
PVC	Polyvinyl Chloride
Reg.	Regulator
Reinf.	Reinforced, Reinforcing
Sec.	Section
St.	Steel
Str.	Structural
sy or sq. yd.	Square Yard(s)
Th.	Thick or Thickness
Tr.	Treatment
VC	Vitrified Clay

### 1-01.3 Definitions

#### **Addendum**

A written or graphic document, issued to all bidders and identified as an addendum prior to bid opening, which modifies or supplements the bid documents and becomes a part of the contract.

#### **Award**

The formal decision of the Owner to accept the lowest responsible and responsive bidder for the work.

#### **Bid, Proposal**

The offer of a bidder on a properly completed proposal form to perform the contract.

#### **Bidder**

An individual, partnership, firm, corporation, or joint venture, submitting a proposal or bid. When required by law or otherwise the individual, partnership, firm, corporation, or joint venture shall be pre-qualified.

#### **Bid Documents**

The component parts of the proposed contract which may include, but are not limited to, the proposal form, the proposed contract provisions, the proposed contract plans, addenda, and subsurface boring logs (if any).

#### **Bond**

Bid, Performance and Payment Bonds and other instruments of surety, furnished by the Contractor and the Contractor's surety in accordance with the Contract Documents.

#### **Call for Bids (Advertisement for Bids)**

The solicitation for proposals or bids for work stating, among other things, the time, place, and date for receiving and opening the bids.

#### **Change Order**

A written order to the Contractor authorizing an addition, deletion or revision in the work within the general scope of the Contract Documents, or authorizing an adjustment in the Contract Price or Contract Time.

**Completion Dates - Substantial Completion Date** is the day the Supervising Contractor determines the Contracting Agency has full and unrestricted use and benefit of the facilities, both from the operational and safety standpoint, and only minor incidental work, replacement of temporary substitute facilities, or correction or repair remains for the physical completion of the total contract.

**Physical Completion Date** is the day all of the work is physically completed on the project. All documentation required by the contract and required by law does not necessarily need to be furnished by the Contractor by this date.

**Completion Date** is the day all the work specified in the contract is completed and all the obligations of the Contractor under the contract are fulfilled by the Contractor. All documentation required by the contract and required by law must be furnished by the Contractor before establishment of this date.

#### **Contract**

The written agreement between the Owner and the Contractor. It describes, among other things:

1. What work will be done, and by when;
2. Who provides labor and materials; and
3. How Contractors will be paid.

The contract includes the contract (agreement) form, bidder's completed proposal form, contract provisions, contract plans, standard specifications, standard plans, addenda, various certifications and affidavits, supplemental agreements, change orders, and subsurface boring logs (if any).

**Contract Bond**

The approved form of security furnished by the Contractor and the Contractor's surety as required by the contract, that guarantees performance of all the work required by the contract and payment to anyone who provides supplies or labor for the performance of the work.

**Contract Form (Agreement Form)**

The form provided by the Owner that requires the authorized signatures of the Contractor and the Owner to result in formal execution of the contract.

**Contractor**

The individual, partnership, firm, corporation, or joint venture, contracting with the Owner to do prescribed work.

**Contract Plans**

A publication addressing the work required for an individual project. At the time of the call for bids, the contract plans may include, but are not limited to, the following: a vicinity map, a summary of quantities, structure notes, signing information, traffic control plans, and detailed drawings; all for a specific individual project. At the time of the contract execution date, the contract plans include any addenda.

**Contract Provisions**

A publication addressing the work required for an individual project. At the time of the call for bids, the contract provisions may include, for a specific individual project, the amendments to the standard specifications, the special provisions, a listing of the applicable standard plans, the prevailing minimum hourly wage rates, and an informational proposal form with the listing of bid items. The proposed contract provisions may also include, for a specific individual project, the Required Contract Provisions Federal-aid Construction Contracts, and various required certifications or declarations. At the time of the contract execution date, the contract provisions include the proposed contract provisions and include any addenda, a copy of the contract form, and a copy of the proposal form with the contract prices and extensions.

**Field Directive**

A written directive to Contractor issued on or after the effective date of the agreement and signed by the Owner and recommended by the Supervising Contractor, ordering an addition deletion or revision in the work, or responding to differing or unforeseen physical conditions under which the work is to be performed. A Field Directive may not change the Contract Price or the Contract Time, but is evidence that the parties expect that the change directed or documented by a Field Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any on the Contract Price or Contract Time.

**Frontage Road**

A local street or road usually next to an arterial highway that serves abutting property and adjacent areas and controls access.

**Highway**

A public way for vehicles, including the entire right of way.

**Inspector**

The Supervising Contractor's representative who inspects contract performance in detail.

**Laboratory**

The laboratories of the Owner, or other laboratories the Owner authorizes to test work, soils, and materials.

**Notice of Award**

The written notice of the acceptance of the Bid from the Owner to the successful bidder.

**Notice to Proceed**

A written notice issued by the Owner to the Contractor (with a copy to Supervising Contractor) fixing the date on which the Contract Time will commence to run and on which Contractor shall start to perform Contractor's obligations under the Contract Document.

**Owner**

For the purposes of this document, the Owner shall mean ASARCO Incorporated, P. O. Box 1677, Tacoma, WA 98401. Owner shall be used interchangeably with RA Coordinator.

**Plans**

The contract plans or standard plans which show location, character, and dimensions of prescribed work including layouts, profiles, cross-sections, and other details.

**Project Engineer**

The Supervising Contractor's representative who directly supervises the engineering and administration of a construction project.

**Proposal Form**

The form provided to bidders by the Owner for submittal of a proposal or bid for a specific project. The form includes the item number, estimated plan quantity, and item description of the bid items along with blank spaces to be completed by the bidder for the unit prices, extensions, the total bid amount, signatures, date, acknowledgment of addenda, and the bidder's address. The required certifications and declarations are part of the form.

**RA Coordinator**

RA Coordinator is the Owner.

**Right of Way**

Land, property, or property interest, usually in a strip, acquired for or devoted to transportation purposes.

**Roadbed**

The graded part of the roadway within top and side slopes, prepared as a foundation for the pavement structure and shoulders.

**Roadway**

The portion of the right of way within the outside limits of the side slopes.

**Shoulder**

The part of the roadway next to the traveled way or auxiliary lanes. It provides lateral support of base and surface courses and is an emergency stopping area for vehicles.

**Special Provisions**

Supplemental specifications and modifications to the standard specifications and the amendments to the standard specifications that apply to an individual project.

**Specifications**

Provisions and requirements for the prescribed work.

**Standard Plans**

A manual of specific plans or drawings adopted by the Owner which show frequently recurring components of work that have been standardized for use.

**State**

The state of Washington.

**Structures**

Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, endwalls, buildings, service pipes, sewers, underdrains, foundation drains, and other features found during work that the contract may or may not classify as a structure.

**Subcontractor**

An individual, partnership, firm, corporation, or joint venture who is sublet part of the contract by the Contractor.

**Subgrade**

The top surface of the roadbed on which subbase, base, surfacing, pavement, or layers of similar materials are placed.

**Substructure**

The part of the structure *below*:

1. Simple and continuous span bearings, or
2. The bottom of the girder or bottom slab soffit, or
3. Arch skewbacks and construction joints at the top of vertical abutment members or rigid frame piers.

Substructures include endwalls, wingwalls, barrier and railing attached to the wingwalls, and cantilever barriers and railings.

**Supervising Contractor**

The Owner's representative who directly supervises the engineering and administers the Contract. For the purposes of this document, the Supervising Contractor shall mean Hydrometrics, Inc., 5219 North Shirley Street, Suite 100, Ruston, WA 98407 (253) 752-1740.

**Surety**

A company that is bound with the Contractor to ensure performance of the contract, payment of all obligations pertaining to the work, and fulfillment of such other conditions as are specified in the contract, contract bond, or otherwise required by law.

**Titles (or Headings)**

The titles or headings of the sections and subsections herein are intended for convenience of reference and shall not be considered as having any bearing on their interpretation.

**Traveled Way**

That part of the roadway made for vehicle travel excluding shoulders and auxiliary lanes.

**Work**

The provision of all labor, materials, tools, equipment, and everything needed to successfully complete a project according to the contract.

**Working Drawings**

Shop drawings, shop plans, erection plans, falsework plans, framework plans, cofferdam, cribbing and shoring plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data, including a schedule of submittal dates for working drawings where specified, which the Contractor must submit to the Supervising Contractor for approval.

**Written Amendment**

A written amendment of the Contract Documents, signed by Owner and Contractor on or after the effective date of the Agreement and normally dealing with the non-engineering or non-technical rather than strictly work related aspects of the Contract Documents.

**1-02 BID PROCEDURES AND CONDITIONS****1-02.1 Vacant****1-02.2 Plans and Specifications**

Copies of the plans, specifications, bidding and contract documents may be obtained from Hydrometrics, Inc., 5219 North Shirley Street, Suite 100, Ruston, WA 98407, in accordance with conditions as set forth in the Notice to Bidders.

After award of the contract, plans and specifications will be provided to the Contractor. For each approved subcontractor or approved material supplier, one set of plans and specifications will be furnished only upon request by the Contractor. Additional copies of the plans and specifications may be obtained on request by paying the actual cost of reproduction.

**1-02.3 Estimated Quantities**

The quantities shown in the proposal form and the contract forms are estimates and are stated only for bid comparison purposes. The Owner does not warrant expressly or by implication, that the actual quantities of work will correspond with those estimates. Payment will be made on the basis of the actual quantities of each item of work completed in accordance with the contract requirements.

**1-02.4 Examination of Plans, Specifications, and Site of Work****1-02.4(1) General**

The bidder shall carefully examine the bid documents as defined in Section 1-01.3. Submittal of a bid shall be conclusive evidence that the bidder has made these examinations and understands all requirements for the performance of the completed work. The bidder further warrants, agrees, and acknowledges by submitting a bid that it:

1. Has taken steps reasonably necessary to ascertain the nature and location of the work;
2. Has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to:
  - a. Conditions bearing upon acquisition, transportation, disposal, handling, and storage of materials;
  - b. The availability of labor, materials, water, electric power, and roads;
  - c. Uncertainties of weather, river stages, tides, or similar physical conditions at the site;
  - d. The conformation and condition of the ground; and
  - e. The character of equipment and facilities needed preliminary to and during work performance;

3. Has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the work site (including material sites) as well as from the bid documents and other information made a part of this contract; and
4. Has satisfied itself as to the adequacy of time allowed for the completion of the physical work on the contract.

Any failure of the bidder to take the actions described and acknowledged in this clause shall not relieve the bidder from responsibility for estimating properly the difficulty and cost of successfully performing the work, or from proceeding to successfully perform the work without additional expense to the Owner.

The bidder agrees that the Owner shall not be liable to it on any claim for additional payment or additional time or any claim whatsoever if the claim directly or indirectly results from the bidder's failure to investigate and familiarize itself sufficiently with the conditions under which the contract is to be performed. The bidder shall be familiar and comply with all Federal, State, and local laws, ordinances, and regulations which might affect those engaged in the work. The Owner will not consider any plea of misunderstanding or ignorance of such requirements.

Bid prices shall reflect what the bidder anticipates to be the cost of completing the work, including methods, materials, labor, and equipment. Except as the contract may provide, the bidder shall receive no payment for any costs that exceed those in the bid prices.

Prospective bidders are advised that projects with work on or adjacent to water may require insurance coverage in compliance with:

1. The Longshoremen's and Harbor Worker's Compensation Act (administered by U.S. Department of Labor), or
2. The State Industrial Insurance (administered by the Washington State Department of Labor and Industries), or
3. Both.

The Contractor shall bear all cost for such insurance as provided in Section 1-07.10. No Claim shall be allowed because of any ambiguity in the contract if:

1. The bidder discovers an ambiguity but fails to notify the Supervising Contractor; or
2. The bidder failed to discover a patent ambiguity that would be discovered by a reasonably prudent contractor in preparing its bid.

Any prospective bidder desiring an explanation or interpretation of the bid documents, must request the explanation or interpretation in writing soon enough to allow a written reply to reach all prospective bidders before the submission of their bids. Oral explanations, interpretations, or instructions given by anyone before the award of a contract will not be binding on the Owner. Any information given a prospective bidder concerning any of the bid documents will be furnished to all prospective bidders as an addendum if that information is deemed by the Owner to be necessary in submitting bids or if the Owner concludes that the lack of the information would be prejudicial to other prospective bidders.

#### **1-02.4(2) Subsurface Information**

If the Owner has made subsurface investigation of the site of the proposed work, the boring log data and soil sample test data accumulated by the Owner will be made available for inspection by the bidders. The boring logs shall be considered as part of the contract. However, the Owner makes no representation or warranty expressed or implied that:

1. The bidders' interpretations from the boring logs are correct;
2. Moisture conditions and indicated water tables will not vary from those found at the time the borings were made; and
3. The ground at the location of the borings has not been physically disturbed or altered after the boring was made.

The Owner specifically makes no representations, guarantees, or warranties as to the condition, materials, or proportions of the materials between the specific borings regardless of any subsurface information the Owner may make available to the prospective bidders.

The availability of subsurface information from the Owner shall not relieve the bidder or the Contractor from any risks or of any duty to make examinations and investigations as required by Section 1-02.4(1) or any other responsibility under the contract or as may be required by law.

#### **1-02.5 Proposal Forms**

The proposal form will identify the project and its location and describe the work. It will also list estimated quantities, units of measurement, the items of work, and the materials to be furnished at the unit bid prices. The bidder shall complete spaces on the proposal form that call for unit prices, extensions, the total bid amount, signatures, date, acknowledgment of addenda, and the bidder's address. The required certifications are included as part of the proposal form.



#### **1-02.6 Preparation of Proposal**

The Owner will accept only those proposals properly executed on forms it provides. Unless it approves in writing, the Owner will not accept proposals on forms attached to the plans and stamped "Informational."

All prices shall be in legible figures (not words) written in ink or typed. The proposal shall include:

1. A unit price for each item (omitting digits more than four places to the right of the decimal point).
2. An extension for each unit price (omitting digits more than two places to the right of the decimal point), and
3. The total contract price (the sum of all extensions).

In the space provided on the signature sheet, the bidder shall confirm that all addenda has been received.

The bidder shall submit with the bid a list of:

1. Subcontractors who will perform work which amounts to more than 10 percent of the bid price, and
2. The work those subcontractors will perform on the contract.

If no subcontractor is listed, the bidder acknowledges that it does not intend to use any subcontractor whose work on the contract will exceed 10 percent of the bid price.

Any firm doing business under an assumed name shall submit a certified copy of a "Certificate of Assumed Name" (unless the Owner already has a copy on file).

Proposals of corporations shall be signed by the officer or officers having authority to sign them. If a bidder is a co-partnership, the proposal shall be signed by an authorized member of the co-partnership. When the bidder is a joint venture, the proposal shall be signed by one or more individuals as authorized by the Joint Venture.

#### **1-02.7 Bid Deposit**

A deposit of 5 percent of the total bid shall accompany each bid. This deposit may be by cash, certified check, cashier's check, or a proposal bond (surety bond). Any proposal bond shall be on a form acceptable to the Owner and shall be signed by the bidder and the surety. A proposal bond shall not be conditioned in any way to modify the minimum 5 percent required. The surety shall: (1) be registered with the Washington State Insurance Commissioner, and (2) appear on the current Authorized Insurance List in the State of Washington published by the Office of the Insurance Commissioner.

The failure to furnish a bid deposit of a minimum of 5 percent shall make the bid nonresponsive and shall cause the bid to be rejected..

#### **1-02.8 Vacant**

#### **1-02.9 Delivery of Proposal**

Each proposal shall be delivered in a sealed envelope.

The Owner may not consider proposals it receives after the time fixed for opening bids in the call for bids.

#### **1-02.10 Withdrawal or Revision of Proposal**

After submitting a bid proposal to the Owner, the bidder may withdraw or revise it if:

1. The bidder submits a written request signed by an authorized person, and
2. The Owner receives the request before the time for opening bids.

The original bid proposal may be revised and resubmitted as the official bid proposal if the Owner receives it before the time for opening bids.

#### **1-02.11 Vacant**

#### **1-02.12 Vacant**

#### **1-02.13 Irregular Proposals**

1. A proposal will be considered irregular and will be rejected if:
  - a. The bidder is not prequalified;
  - b. The authorized proposal form furnished by the Owner is not used or is altered;
  - c. The completed proposal form contains any unauthorized additions, deletions, alternate bids, or conditions;
  - d. The bidder adds provisions reserving the right to reject or accept the award, or enter into the contract;

- e. A price per unit cannot be determined from the bid proposal;
  - f. The proposal form is not properly executed;
  - g. The bidder fails to submit or properly complete a subcontractor list, if applicable, as required in Section 1-02.6.
  - h. The bid proposal does not constitute a definite and unqualified offer to meet the material terms of the bid invitation.
2. A proposal may be considered irregular and may be rejected if:
- a. The proposal does not include a unit price for every bid item;
  - b. Any of the unit prices are excessively unbalanced (either above or below the amount of a reasonable bid) to the potential detriment of the Owner;
  - c. Receipt of addenda is not acknowledged;
  - d. A member of a joint venture and the joint venture submit proposals for the same project (in such an instance, both bids may be rejected); or
  - e. If proposal form entries are not made in ink.

#### **1-02.14 Disqualification of Bidders**

A bidder may be deemed not responsible and the proposal rejected if:

- 1. More than one proposal is submitted for the same project from a bidder under the same or different names;
- 2. Evidence of collusion exists with any other bidder. Participants in collusion will be restricted from submitting further bids;
- 3. A bidder is not pre-qualified for the work or to the full extent of the bid;
- 4. Unsatisfactory references are provided;
- 5. There are any other reasons deemed proper by the Owner.

#### **1-02.15 Pre-Award Information**

Before awarding any contract, the Owner may require one or more of these items or actions of the apparent lowest responsible bidder:

- 1. A complete statement of the origin, composition, and manufacture of any or all materials to be used,
- 2. Samples of these materials for quality and fitness tests,
- 3. A progress schedule (in a form the Owner requires) showing the order of and time required for the various phases of the work,
- 4. A breakdown of costs assigned to any bid item,
- 5. Attendance at a conference with the Owner and/or Supervising Contractor, or
- 6. Any other information or action taken that is deemed necessary to ensure that the bidder is the lowest responsible bidder.

### **1-03 AWARD AND EXECUTION OF CONTRACT**

#### **1-03.1 Consideration of Bids**

After opening and reading proposals, the Owner will check them for correctness of extensions of the prices per unit and the total price. If a discrepancy exists between the price per unit and the extended amount of any bid item, the price per unit will control. The total of extensions, corrected where necessary, will be used by the Owner for award purposes and to fix the amount of the contract bond.

The right is reserved by the Owner to waive informalities in the bidding, accept a proposal of the lowest responsible bidder, reject any or all bids, republish the call for bids, revise or cancel the work, or require the work to be done in another way if the best interest of the Owner is served.

In addition to such other rights as may be reserved elsewhere in the Contract Documents, the Owner reserves the right to accept a Bid of the most favorable responsible Bidder, as determined by the Owner, to make arithmetical corrections in a Bid, to negotiate prices with the most favorable responsible Bidder, or to require the Work be done in another way if in the opinion of the Owner his best interests will be served.

#### **1-03.2 Award of Contract**

Normally, contract award or bid rejection will occur within 45 calendar days after bid opening. If the most favorable, responsive, responsible, qualified Bidder and the Owner agree, this deadline may be extended. If they cannot agree on an extension by the 45 calendar day deadline, the Owner reserves the right to award the contract to the next lowest responsible bidder or reject all bids. The Owner will notify the successful bidder of the contract award in writing.

#### **1-03.3 Execution of Contract**

Within 20 calendar days after the award date, the successful bidder shall return the signed Owner -prepared contract, an insurance certification as required by Section 1-07.18, and a satisfactory bond as required by law and Section 1-03.4. Before execution of the contract by the Owner, the successful bidder shall provide any pre-award information the Owner may require under Section 1-02.15.

Until the Owner executes a contract, no proposal shall bind the Owner nor shall any work begin within the project limits or within Owner-furnished sites. The Contractor shall bear all risks for any work begun outside such areas and for any materials ordered before the contract is executed by the Owner.

If the bidder experiences circumstances beyond their control that prevents return of the contract documents within 20 calendar days after the award date, the Owner may grant up to a maximum of 20 additional calendar days for return of the documents, provided the Owner deems the circumstances warrant it.

#### **1-03.4 Contract Bond**

If the Owner has so requested prior to the signing of this Contract, the Contractor shall furnish bond covering the faithful performance of this Contract and the payment of all obligations arising thereunder, in such form as the Owner may prescribe and with such sureties as it may approve. If such bond was required by instructions given previous to the receipt of bids, the premium shall be paid by the Contractor; if subsequent thereto, it shall be paid by the Owner. If any change in work is authorized pursuant to the terms of this Contract, Contractor shall cooperate with Owner so as to ensure Owner's ability to secure and maintain the bonds for same.

#### **1-03.5 Failure to Execute Contract**

Failure to return the insurance certification and bond with the signed contract as required in Section 1-03.3, or failure or refusal to sign the contract shall result in forfeiture of the proposal bond or deposit of this bidder.

#### **1-03.6 Return of Bid Deposit**

When proposals have been examined and corrected as necessary, proposal bonds and deposits accompanying proposals ineligible for further consideration will be returned. All other proposal bonds and deposits will be held until the contract has been properly executed. When the contract has been properly executed, all remaining deposits or bonds, except those subject to forfeiture, will be returned.

#### **1-03.7 Vacant**

### **1-04 SCOPE OF THE WORK**

#### **1-04.1 Intent of the Contract**

The intent of the contract is to prescribe a complete work. Omissions from the contract of details of work which are necessary to carry out the intent of the contract, or which are customarily performed, shall not relieve the Contractor from performing the omitted work.

##### **1-04.1(1) Bid Items Included in the Proposal**

The Contractor shall provide all labor, materials, tools, equipment, transportation, supplies, and incidentals required to complete all work for the items included in the proposal.

##### **1-04.1(2) Bid Items Not Included in the Proposal**

When the contract specifies work, and there is no bid item for that work, an equitable adjustment will be made in accordance with Section 1-04.4 if that work is not customarily specified as being included with or incidental to other bid items in the contract.

#### **1-04.2 Coordination of Contract Documents, Plans, Special Provisions Specifications, and Addenda**

The complete contract includes these parts: the contract form, bidder's completed proposal form, contract plans, contract provisions, standard specifications, standard plans, addenda, various certifications and affidavits, supplemental agreements, change orders, and subsurface boring logs (if any). These parts complement each other in describing a complete work. Any requirement in one part binds as if stated in all parts. The Contractor shall provide any work or materials clearly implied in the contract even if the contract does not mention it specifically.

Any inconsistency in the parts of the contract shall be resolved by following this order of precedence (e.g., 1 presiding over 2, 3, 4, 5, 6, and 7; 2 presiding over 3, 4, 5, 6, and 7; and so forth):

1. Addenda,
2. Proposal Form, including Envirocon proposals date 11/4/99 and 11/24/99, Envirocon letter dated 12/21/99 (revised) and clarifications made to scope of work, formalized in responses made to Asarco letter dated 12/10/99 and presented in meeting held 12/17/99,
3. Special Provisions,
4. Contract Plans,
5. Amendments to the Standard Specifications,
6. Standard Specifications, and
7. Standard Plans.

On the contract plans, working drawings, and standard plans, figured dimensions shall take precedence over scaled dimensions.

This order of precedence shall not apply when work is required by one part of the contract but omitted from another part or parts of the contract. The work required in one part must be furnished even if not mentioned in other parts of the contract.

If any part of the contract requires work that does not include a description for how the work is to be performed, the work shall be performed in accordance with standard trade practice(s). For purposes of the contract, a standard trade practice is one having such regularity of observance in the trade as to justify an expectation that it will be observed by the Contractor in doing the work.

In case of any ambiguity or dispute over interpreting the contract, the Supervising Contractor's decision will be final as provided in Section 1-05.1.

#### **1-04.3 General Notice**

This remediation project is in response to the Consent Decree for Remedial Design and Remediation of the Tacoma Smelter Site issued by the United States Department of Justice, and lodged in U.S. District Court on June 24, 1996, and entered in U.S. District Court on January 3, 1997. It is intended to implement the remedial actions specifically required by that document and the work plans submitted by Asarco and approved by EPA. The Contractor shall be aware of and comply with all applicable Federal, State, and local laws, especially those relating to hazardous waste handling and environmental protection.

##### **1-04.3(1) Contractor Submittals:**

Submittals required of the Contractor are described in these Standard Specifications, the Special Provisions, and the Construction Quality Assurance Plan. The submittals may include, but are not limited to, materials specifications, testing results, proposed construction methods, equipment to be utilized, schedules, proposed subcontractors, materials samples, and other specified documentation.

For the purposes of this Contract, a minimum of three (3) complete sets, unless otherwise noted, shall be furnished.

The Supervising Contractor will furnish a copy of the required submittals to EPA.

#### **1-04.4 Changes**

The Owner may at any time change the work within the general scope of the contract. Among others, these changes may include:

1. Deleting any part of the work;
2. Increasing or decreasing quantities;
3. Altering specifications, designs, or both;
4. Revising the way the work is to be done;
5. Adding new work;
6. Altering Owner -provided facilities, equipment, materials, services or sites; or
7. Ordering the Contractor to speed up or delay the work.

The Supervising Contractor will issue a written change order for any change unless the remainder of this section provides otherwise.

For Item 1, an equitable adjustment for deleted work will be made as provided in Section 1-09.5.

For Item 2, if the actual quantity of any item increases or decreases by more than 25 percent from the original plan quantity, the unit contract prices for that item may be adjusted in accordance with Section 1-04.6

For any change except Item 1 (deleted work) or Item 2 (increasing or decreasing quantities) the Supervising Contractor will determine if the change should be paid for at unit contract price(s). If the Supervising Contractor determines that the change increased or decreased the Contractor's costs or time to do any of the work including unchanged work, the Supervising Contractor will make an equitable adjustment to the contract. The equitable adjustment will be by agreement with the Contractor. However, if the parties are unable to agree, the Supervising Contractor will determine the amount of the equitable adjustment in accordance with Section 1-09.4 and adjust the time as the Supervising Contractor deems appropriate. Extensions of time will be evaluated in accordance with Section 1-08.8. The Supervising Contractor's decision concerning equitable adjustment and extension of time shall be final as provided in Section 1-05.1

The Contractor shall proceed with the work upon receiving:

1. A written change order approved by the Owner, or
2. An oral order from the Supervising Contractor or Owner before actually receiving the written change order.

Changes normally noted on field stakes will not require a written change order. These changes shall be made at the unit prices that apply. The Contractor shall respond immediately to changes shown on field stakes without waiting for further notice.

#### **1-04.5 Procedure and Protest by the Contractor**

If in disagreement with anything required in a change order, another written order, or an oral order from the Supervising Contractor, including any direction, instruction, interpretation, or determination by the Supervising Contractor, the Contractor shall:

1. Immediately give a signed written notice of protest to the Supervising Contractor or the Supervising Contractor's field inspectors before doing the work;
2. Supplement the written protest within 15 calendar days with a written statement providing the following:
  - a. The date of the protested order;
  - b. The nature and circumstances which caused the protest;
  - c. The contract provisions that support the protest;
  - d. The estimated dollar cost, if any, of the protested work and how that estimate was determined; and
  - e. An analysis of the progress schedule showing the schedule change or disruption if the Contractor is asserting a schedule change or disruption; and
3. If the protest is continuing, the information required above, shall be supplemented as requested by the Supervising Contractor. In addition, the Contractor shall provide the Supervising Contractor, before final payment, a written statement of the actual adjustment requested.

Throughout any protested work, the Contractor shall keep complete records of extra costs and time incurred. The Contractor shall permit the Supervising Contractor access to these and any other records needed for evaluating the protest as determined by the Supervising Contractor.

The Supervising Contractor will evaluate all protests provided the procedures in this section are followed. If the Supervising Contractor determines that a protest is valid, the Supervising Contractor will adjust payment for work or time by an equitable adjustment in accordance with Section 1-09.4. Extensions of time will be evaluated in accordance with Section 1-08.8. No adjustment will be made for an invalid protest.

In spite of any protest, the Contractor shall proceed promptly with the work as the Supervising Contractor orders.

The Contractor accepts all requirements of a change order by: (1) endorsing it, (2) writing a separate acceptance, or (3) not protesting in the way this section provides. A change order that is not protested as provided in this section shall be full payment and final settlement of all claims for contract time and for all costs of any kind, including costs of delays, related to any work either covered or affected by the change.

By not protesting as this section provides, the Contractor also waives any additional entitlement and accepts from the Supervising Contractor any written or oral order (including directions, instructions, interpretations, and determinations).

By failing to follow the procedures of this section and Section 1-09.11, the Contractor completely waives any claims for protested work.

#### **1-04.6 Increased or Decreased Quantities**

Payment to the Contractor will be made only for the actual quantities of work performed and accepted in conformance with the contract. When the accepted quantities of work vary from the original bid quantities, payment will be at the unit contract prices for accepted work unless the total quantity of any contract item, using the original bid quantity, increases or decreases by more than 25 percent. In that case that part of the increase or decrease exceeding 25 percent will be adjusted as follows:

1. **Increased Quantities.**  
Either party to the contract will be entitled to renegotiate the price for that portion of the actual quantity in excess of 125 percent of the original bid quantity. The price for increased quantities will be determined by agreement of the parties, or, where the parties cannot agree, the price will be determined by the Supervising Contractor based upon the actual costs to perform the work, including reasonable markup for overhead and profit.
2. **Decreased Quantities.**  
Either party to the contract will be entitled to an equitable adjustment if the actual quantity of work performed is less than 75 percent of the original bid quantity. The equitable adjustment in the case of decreased quantities shall be based upon any increase or decrease in costs due solely to the variation of the estimated quantity. The total payment for any item will be limited to no more than 75 percent of the amount originally bid for the item.

The following limitations shall apply to the adjustment:

1. The equipment rates shall be actual cost but shall not exceed the rates set forth in the AGC/WSDOT Equipment Rental Agreement in effect at the time the work is performed as referred to in Section 1-09.6.

2. No payment will be made for extended or unabsorbed home office overhead and field overhead expenses to the extent that there is an unbalanced allocation of such expenses among the contract bid items.
3. No payment for consequential damages or loss of anticipated profits will be allowed because of any variance in quantities from those originally shown in the proposal form, contract provision, and contract plans.

When ordered by the Supervising Contractor, the Contractor shall proceed with the work pending determination of the cost or time adjustment for the variation in quantities.

The Owner will not adjust for increases or decreases if the Owner has entered the amount for the item in the proposal form only to provide a common proposal for bidders.

#### **1-04.7 Differing Site Conditions (Changed Conditions)**

The Contractor shall promptly, and before such conditions are disturbed, notify the Supervising Contractor in writing of: (1) preexisting subsurface or latent physical conditions at the site differing materially from those indicated in this contract, or (2) preexisting unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in this contract. The Supervising Contractor will promptly investigate the conditions. If the Supervising Contractor finds that conditions are materially different and cause a material increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the work under this contract whether or not changed as a result of such conditions, the Supervising Contractor will make an equitable adjustment in the payment or the time required for the performance of the work. Extensions of time will be evaluated in accordance with Section 1-08.8. The equitable adjustment will be by agreement with the Contractor. However, if the parties are unable to agree, the Supervising Contractor will determine the amount of the equitable adjustment in accordance with Section 1-09.4. If the Supervising Contractor determines that differing site conditions do not exist and no adjustment in costs or time is warranted, such determination shall be final as provided in Section 1-05.1.

No claim of the Contractor, under this clause, shall be allowed unless the Contractor has given the notice required. The time for giving notice will not be extended beyond the time that the Contractor knew or should have known of the existence of the differing site condition. If there is a decrease in the costs or time required to perform the work, failure of the Contractor to notify the Supervising Contractor of the differing site condition shall not affect the Owner's right to make an adjustment in the costs or time.

Additionally, no claim by the Contractor shall be allowed unless the Contractor has followed the procedures provided in Sections 1-04.5 and 1-09.11.

#### **1-04.8 Progress Estimates and Payments**

Supervising Contractor-issued progress estimates or payments for any part of the work shall not be used as evidence of performance or quantities. Progress estimates serve only as basis for partial payments. The Supervising Contractor may revise progress estimates any time before final acceptance. If the Supervising Contractor deems it proper to do so, changes may be made in progress estimates and in the final estimate.

#### **1-04.9 Use of Buildings or Structures**

The Supervising Contractor will decide whether any building or structure on the right of way may remain during the work and whether the Contractor may use such a building or structure.

Property lines, limits of easements, and limits of construction permits are indicated as appropriate on the plans and it shall be the Contractor's responsibility to confine his construction activities within these limits, unless he makes arrangements for use of private property. Before using any private property adjoining the work, the Contractor shall file with the Supervising Contractor a written permission of the property owner, and upon vacating the premises the Contractor shall furnish the Supervising Contractor with a release from all damages, properly executed by the property owner.

The Contractor shall confine his equipment, storage of materials and operation of work to the limits indicated by law, ordinances, permits or direction of Supervising Contractor, and shall not unreasonably encumber the premises with his materials.

If the Contractor desires to use or permit any building or structure within the construction limits to remain during the performance of the contract, such use or existence will be at the discretion of the Supervising Contractor.

#### **1-04.10 Use of Materials Found on the Project**

With the Supervising Contractor's written approval, the Contractor may use on the project: stone, gravel, sand, other materials from on-site excavation, or timbers removed in the course of the work. Approval will not be granted if:

1. The excavated materials or timber fail to meet contract requirements;
2. The excavated materials or timber are required for other use under the contract;
3. The excavated materials are required for use as Selected Materials under Section 2-03.3(10); or

4. Such use is not in the best interests of the Owner as determined by the Supervising Contractor, whose decision shall be final as provided in Section 1-05.1.

Any material disturbed by, but not used in, the work shall be disposed of as provided elsewhere in the contract or as directed by the Supervising Contractor.

#### **1-04.11 Final Cleanup**

The Contractor shall perform final cleanup as provided in this section to the Supervising Contractor's satisfaction. The Supervising Contractor will not establish the physical completion date until this is done. The highway right of way, material sites, and all ground the Contractor occupied to do the work shall be left neat and presentable. The Contractor shall:

1. Remove all rubbish, surplus materials, discarded materials, falsework, camp buildings, temporary structures, equipment, and debris; and
2. Deposit in embankments, or remove from the project, all unneeded, oversized rock left from grading, surfacing, or paving.

The Contractor shall not remove warning, regulatory, or guide signs unless the Supervising Contractor approves.

### **1-05 CONTROL OF WORK**

#### **1-05.1 Authority of the Supervising Contractor**

The Supervising Contractor shall be satisfied that all the work is being done in accordance with the requirements of the contract. The contract and specifications give the Supervising Contractor authority over the work. Whenever it is so provided in this contract, the decision of the Supervising Contractor shall be final; provided, however, that if an action is brought within the time allowed in this contract challenging the Supervising Contractor's decision, that decision shall be subject to the scope of judicial review provided in such cases under Washington case law.

The Supervising Contractor's decisions will be final on all questions including, but not limited to, the following:

1. Quality and acceptability of materials and work,
2. Measurement of unit price work,
3. Acceptability of rates of progress on the work,
4. Interpretation of plans and specifications,
5. Determination as to the existence of changed or differing site conditions,
6. Fulfillment of the contract by the Contractor,
7. Payments under the contract including equitable adjustment,
8. Suspension(s) of work,
9. Termination of the contract for default or public convenience,
10. Determination as to unworkable days, and
11. Approval of working drawings.

The Supervising Contractor represents the Owner on the project, with full authority to enforce contract requirements and carry out the Owner's orders. If the Contractor fails to respond promptly to the requirements of the contract or orders from the Supervising Contractor:

1. The Supervising Contractor may use Owner resources, other contractors, or other means to accomplish the work, and
2. The Owner will not be obligated to pay the Contractor, and will deduct from the Contractor's payments any costs that result when any other means are used to carry out the contract requirements or Supervising Contractor's orders.

At the Contractor's risk, the Supervising Contractor may suspend all or part of the work if:

1. The Contractor fails to fulfill contract terms, to carry out the Supervising Contractor's orders, or to correct unsafe conditions of any nature;
2. The weather or other conditions are unsuitable; or
3. It is in the public interest.

Nothing in these Specifications or in the contract requires the Supervising Contractor to provide the Contractor with direction or advice on how to do the work. If the Supervising Contractor approves or recommends any method or manner for doing the work or producing materials, the approval or recommendation shall not:

1. Guarantee that following the method or manner will result in compliance with the contract,
2. Relieve the Contractor of any risks or obligations under the contract, or
3. Create any Owner liability.

#### **1-05.2 Authority of Assistants and Inspectors**

The Supervising Contractor may appoint assistants and inspectors to assist in determining that the work and materials meet the contract requirements. Assistants and inspectors have the authority to reject defective material and suspend work that is being done improperly, subject to the final decisions of the Supervising Contractor.

Assistants and inspectors are not authorized to accept work, to accept materials, to issue instructions, or to give advice that is contrary to the contract. Work done or material furnished which does not meet the contract requirements shall be at the Contractor's risk and shall not be a basis for a claim even if the inspectors or assistants purport to change the contract.

Assistants and inspectors may advise the Contractor of any faulty work or materials or infringements of the terms of the contract; however, failure of the Supervising Contractor or the assistants or inspectors to advise the Contractor does not constitute acceptance or approval.

#### **1-05.3 Plans and Working Drawings**

The contract plans are defined in Section 1-01.3. Any proposed alterations by the Contractor affecting the requirements and information in the contract plans shall be in writing and will require approval of the Supervising Contractor.

To detail and illustrate the work, the Supervising Contractor may furnish to the Contractor additional plans and explanations consistent with the original plans. The Contractor shall perform the work according to these additional plans and explanations.

The Contractor shall submit supplemental working drawings as required for the performance of the work. The drawings shall be on sheets measuring 22 by 34 inches, 11 by 17 inches, or on sheets with dimensions in multiples of 8 1/2 by 11 inches. The drawings shall be provided far enough in advance of actual need to allow for the review process by the Owner or other agencies. This may involve re-submittals because of revisions or rejections. Unless otherwise stated in the contract, the Supervising Contractor will require up to 30 calendar days from the date the submittals or re-submittals are received until they are sent to the Contractor. This time will increase if the drawings submitted do not meet the contract requirements or contain insufficient details.

If more than 30 calendar days are required for the Supervising Contractor's review of any individual submittal or re-submittal, an extension of time will be considered in accordance with Section 1-08.8.

The Contractor shall obtain the Supervising Contractor's written approval of the drawings before proceeding with the work they represent. This approval shall neither confer upon the Owner nor relieve the Contractor of any responsibility for the accuracy of the drawings or their conformity with the contract. The Contractor shall bear all risk and all costs of any work delays caused by nonapproval of these drawings or plans.

Unit bid prices shall cover all costs of working drawings.

#### **1-05.4 Conformity With and Deviations From Plans and Stakes**

The Contractor will lay out and set any construction stakes and marks needed to establish the lines, grades, slopes, cross-sections, and curve superelevations. Contractors staking shall be based on baselines and control points established by the Supervising Contractor. These stakes and marks will govern the Contractor's work. The Contractor shall take full responsibility for detailed dimensions, elevations, and slopes measured from them.

All work performed shall be in conformity with the lines, grades, slopes, cross sections, superelevation data, and dimensions as shown in the plans. If the plans, special provisions, or these Specifications state specific tolerances, the work shall be performed within those limits. The Supervising Contractor's decision on whether the work is in conformity shall be final, as provided in Section 1-05.1.

The Contractor shall not deviate from the approved plans and working drawings unless the Supervising Contractor approves in writing.

To gain better control with unusual pavement widths, critical slopes, or for other reasons, the Contractor will set more control stakes without added cost to the Owner. The Contractor shall set reference lines from these control stakes for trimming subgrade, for surfacing, and for controlling the paving machine.

The Contractor shall preserve stakes and marks. The Owner will deduct from payments due the Contractor all costs to replace baseline or control stakes and marks damaged or destroyed by the Contractor's operation.

The Contractor shall provide enough safe areas to permit the Supervising Contractor to set points and elevations.

The Supervising Contractor will conduct survey for measurement and payment purposes at no cost to the Contractor.

#### **1-05.5 Vacant**



#### **1-05.6 Inspection of Work and Materials**

The Supervising Contractor may inspect all work and materials for conformity with contract terms. To ensure the Supervising Contractor's safety and access during these inspections, the Contractor shall provide any equipment needed, such as walkways, railings, ladders, and platforms.

When the Supervising Contractor requests, the Contractor shall (without charge) provide samples of materials used or to be used in the work. If the Contractor uses materials tested and approved for one project in an unrelated project, the Owner may deduct its testing and inspection costs from payments due the Contractor. The Supervising Contractor may order the Contractor to remove and replace, and bear the cost of doing so, any materials used without inspection.

Any inspections, tests, measurements, or other actions by Supervising Contractor employees serve only one purpose: to assure the Owner that work, materials, progress rate, and quantities comply with contract terms. Such work by Supervising Contractor employees shall not relieve the Contractor from doing any contract-assigned work or from determining whether contract requirements are being met. The Contractor shall correct any substandard work or materials. The Supervising Contractor will reject unsuitable work or materials even though inspected or paid for in a progress estimate.

If the Supervising Contractor requests, the Contractor shall remove or uncover any area of the completed work. After the Supervising Contractor inspects it, the Contractor shall restore the area to the standard the contract requires. The Contractor shall bear the cost of uncovering, removing, and restoring the exposed work: (a) if it proves unacceptable, or (b) if it was placed without authority or without due notice to the Supervising Contractor. The Owner will pay these costs by agreed price or by force account if the work proves to be acceptable and the Contractor had performed the original work with the authority of and due notice to the Supervising Contractor.

The Contractor, if advised to do so by the Supervising Contractor, shall permit representatives from other agencies to inspect the work when it is to be done:

1. On any railroad, utility, or facility of a public agency; or
2. To the satisfaction of any federal, state, or municipal agency.

In any crushing or screening operation, the Contractor shall provide and install a mechanical sampler that:

1. Is automatic or semiautomatic;
2. Can safely and easily obtain representative samples of the materials being produced;
3. Can convey the samples to ground level in sacks or buckets;
4. Moves at an even rate through the full width of the materials stream falling from the discharge end of the belt, gate, or chute;
5. Is power driven during the material intercept cycle; and
6. Can be adjusted to take samples of about 100 pounds as often as the Supervising Contractor requires.

No material from the crushing or screen operation will be accepted until after the Supervising Contractor has approved the design and operation of the sampling equipment. The Contractor shall bear all costs of providing the sampling equipment, the power to operate it, and the space for its use.

#### **1-05.7 Removal of Defective and Unauthorized Work**

The Owner will not pay for unauthorized or defective work. Unauthorized or defective work includes: work and materials that do not conform to contract requirements; work done beyond the lines and grades set by the plans or the Supervising Contractor; and extra work and materials furnished without the Supervising Contractor's written approval. At the Engineer's order, the Contractor shall immediately remedy, remove, replace, or dispose of unauthorized or defective work or materials and bear all costs of doing so.

#### **1-05.8 Vacant**

#### **1-05.9 Equipment**

The Contractor shall provide an operating and maintenance manual for each model or type of mixing, placing, or processing equipment before using it in the work. The Contractor shall also provide test instruments to confirm whether the equipment meets operating requirements, such as vibration rate, revolutions-per-minute, or any other requirements.

The contract may require automatically controlled equipment for some operations. If the automatic controls on such equipment fails, the Contractor may operate the equipment manually for the remainder of that normal working day, provided the method of operation produces results otherwise meeting the specifications. Continued operation of the equipment manually beyond this working day will be permitted only by specific authorization of the Supervising Contractor.

The Supervising Contractor will reject equipment that repeatedly breaks down or fails to produce results within the required tolerances. The Contractor shall have no claim for additional payment or for extension of time due to rejection and replacement of any equipment.

#### **1-05.10 Guarantees**

The Contractor shall furnish to the Owner any guarantee or warranty furnished as a normal trade practice in connection with the purchase of any equipment, materials, or items used in the construction of the project.

#### **1-05.11 Final Inspection**

The Supervising Contractor will not make the final inspection until the physical work required by the contract, including final cleanup and all extra work ordered by the Supervising Contractor, has been completed. The physical completion date for the contract will be determined as provided in Section 1-08.5.

#### **1-05.12 Final Acceptance**

A Certificate of Completion for the project, submitted by the Supervising Contractor and approved by the Owner, shall constitute final acceptance of the work.

Final acceptance shall not constitute acceptance of any unauthorized or defective work or material, nor shall progress estimates be construed as acceptance of any work under this contract. The Owner shall not be barred from requiring the Contractor to remove, replace, repair, or dispose of any unauthorized or defective work or from recovering damages for any such work or material.

Projects will generally be accepted in respect to construction at such time as they are entirely completed. However, on a project consisting of several separate entities, the Supervising Contractor may not accept any of these separate sections if the Supervising Contractor so elects.

#### **1-05.13 Superintendents, Labor, and Equipment of Contractor**

At all times, the Contractor shall keep at the work site a set of the plans, specifications, special provisions, and addenda. The Contractor shall devote the attention required to make reasonable progress on the work and shall cooperate fully with the Supervising Contractor and inspectors.

Either the Contractor in person or an authorized representative shall remain on site whenever the work is underway. Before the work begins, the Contractor shall name in writing an experienced superintendent who understands the contract and is able to supervise the work. This superintendent shall have full authority to represent and act for the Contractor. Any superintendent who repeatedly fails to follow the Supervising Contractor's written or oral orders, directions, instructions, or determinations, shall be subject to removal from the project. Upon the written request of the Supervising Contractor, the Contractor shall immediately remove such superintendent and name a replacement in writing.

Competent supervisors experienced in the task being performed shall continuously oversee the contract work. At the Supervising Contractor's written request, the Contractor shall immediately remove and replace any incompetent, careless, or negligent employee.

Noncompliance with the Supervising Contractor's request to remove and replace personnel at any level shall be grounds for terminating the contract under the terms of Section 1-08.10.

The Contractor shall keep all machinery and equipment in good, workable condition. It shall be adequate for its purpose and used by competent operators.

#### **1-05.14 Cooperation With Other Contractors**

The Owner may perform other work at or near the site, including any material site, with other forces than those of the Contractor. This work may be done with or without a contract. If such work takes place within or next to this project, the Contractor shall cooperate with all other contractors or forces. The Contractor shall carry out work under this project in a way that will minimize interference and delay for all forces involved. The Supervising Contractor will resolve any disagreements that may arise among the contractors or the Contractor and the Owner over the method or order of doing the work. The Supervising Contractor's decision in these matters shall be final, as provided in Section 1-05.1.

The coordination of the work shall be taken into account by the Contractor as part of the site investigation in accordance with Section 1-02.4 and any resulting costs shall be incidental and included within the unit bid prices in the contract.

The Contractor shall conduct the work so as to cause a minimum of interference with the Owner's operations. Where interference with the Owner's operations becomes absolutely necessary, permission shall be requested by the Contractor not less than seventy-two (72) hours in advance.

When other Contractors or the Owner's forces are working on the job on the immediate premises, the Contractor agrees to so schedule the Contractor's work as not to make it necessary for the Contractor to cut into or otherwise alter any work that has been completed by such other persons. If the Contractor fails to do so, then the Contractor shall replace or repair the damaged work at Contractor's own expense and in a manner satisfactory to the Owner.

If any part of the Contractor's work depends for proper execution or results upon the work of any other person, the Contractor shall inspect and promptly report to the Owner any defects in such work that render it unsuitable for such proper execution and results. Contractor's failure to so inspect and report shall constitute an acceptance of such other work as fit and proper for the reception of Contractor's work, except as to defects which may develop in such other work after the execution of Contractor's work.

#### **1-05.15 Vacant**

#### **1-05.16 Water and Power**

The Owner will supply water, electricity and sewer hookups at the locations shown on the site plan. Contractors shall be responsible for providing their own connections.

The Owner will not supply light, steam, compressed air or other utilities required for construction purposes unless specifically so provided in the Contract. Where such items are not supplied by the Owner they shall be furnished by the Contractor, and the Contractor shall, in either case, be required to obtain and pay for required permits and make the necessary connections, provide approved shut-off and safety devices and furnish and install all temporary lines required to bring them to the point of use.

Unless otherwise specified, all materials incorporated in the permanent work shall be new and both workmanship and materials shall be of the best quality. The Contractor shall furnish satisfactory evidence as to the kind and quality of materials.

The Contractor shall construct and maintain all necessary temporary facilities for the completion of the work. Upon completion of the work all such facilities shall, unless the Owner shall otherwise direct, be removed from the premises and the site cleared.

### **1-06 CONTROL OF MATERIAL**

#### **1-06.1 Source of Supply and Quality of Materials**

Promptly after receiving the contract award, the Contractor shall notify the Supervising Contractor of all proposed materials sources, including any steel or other fabricators. These sources shall be approved by the Supervising Contractor before delivery begins. If approved sources are unable to provide acceptable or uniform products, the Contractor shall locate other sources and obtain approval for them.

All equipment, materials, and articles incorporated into the permanent work:

1. Shall be new, unless the special provisions permit otherwise;
2. Shall meet the requirements of the contract and be approved by the Supervising Contractor;
3. May be inspected or tested at any time during their preparation and use; and
4. Shall not be used in the work if they become unfit after being previously approved.

#### **1-06.2 Acceptance of Materials**

##### **1-06.2(1) Samples and Tests for Acceptance**

The Contractor shall deliver representative samples (from the Contractor, Producer, or Fabricator) to the Supervising Contractor without charge before incorporating material into the work. In providing samples, the Contractor shall provide the Supervising Contractor with sufficient time and quantities for testing before use. The Supervising Contractor may require samples at any time. Samples not taken by or in the presence of the Supervising Contractor will not be accepted for test, unless the Supervising Contractor permits otherwise.

The Contractor shall designate specific contractor employees as points of contact for concrete testing and acceptance. Alternates shall be designated to ensure that direct contact is maintained during concrete placement. If designated by the Contractor to the Supervising Contractor, the concrete supplier will receive all 28 day concrete strength test results.

All field and laboratory materials testing by the Supervising Contractor will follow methods described in contract documents, in the site Comprehensive Plans & Documents, the Washington State Department of Transportation Laboratory Manual, or in the recognized standards of national organizations. The following provisions will apply when the Owner uses the specifications or methods from the sources named below:

**ASTM** — American Society for Testing and Materials. The ASTM designation number refers to this society's latest adopted or tentative standard. The standard or tentative standard in effect on the bid advertising date will apply in each case. The Owner will consider any revisions to become effective on December 1 of the year they are adopted. Copies of any separate ASTM specifications or testing method may be obtained from: the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA.

**AASHTO** — American Association of State Highway and Transportation Officials. An AASHTO number refers to that organization's currently published (1) "Standard Specifications for Highway Materials and Methods of Sampling and Testing" or any adopted revisions, or (2) "Interim Specifications and Methods of Sampling and Testing Adopted by the AASHTO Subcommittee on Materials." Any standards, revisions, and interim standards in effect on the bid advertising date will apply. Standards, revisions, and interim standards will be considered as becoming effective on December 1 of the year which they are adopted. Copies of "Standard Specifications for Highway Materials and Methods of Sampling and Testing" may be obtained from the American Association of State Highway and Transportation Officials, 917 National Press Building, Washington, D.C.

**Federal Specification** — U.S. Government Federal Stock Catalogue. The specification number refers to the most recent revision adopted by the General Services Administration. Revisions in effect on the bid advertising date will apply. The Owner will consider any revision as in effect 60 calendar days after its adoption. Copies of separate specifications listed in the Federal Stock Catalogue may be obtained at the prices indicated from the Business Service Center, General Services Administration, Regional Office Building, Seventh and D Streets, Washington, D.C.

**Other Publications** — Any other publication referred to in these Specifications or the special provisions will mean its latest edition. Requirements, and any revisions, in effect on the bid advertising date will apply. The Owner will consider them as in effect 60 calendar days after publication. Copies may be obtained from the publishing organizations. For example, copies of standard grading and dressing rules may be obtained from: West Coast Lumber Inspection Bureau in Seattle, Washington or Portland, Oregon, and from the Western Wood Products Association, Portland, Oregon.

The Contractor may observe any of the sampling and testing performed by the Supervising Contractor. If the Contractor observes a deviation from the specified sampling and testing procedures, the Contractor shall verbally describe the deviations observed to the Supervising Contractor or designated representative immediately, and shall confirm these observed deviations in writing to the Supervising Contractor within 24 hours, referencing the specific procedure steps. The Supervising Contractor will respond in writing within three working days of the receipt of the Contractor's written communication.

#### **1-06.2(2) Statistical Evaluation of Materials for Acceptance**

##### **1-06.2(2)A General**

Where specified, acceptance sampling and testing will be done by the Owner and statistically evaluated for acceptance by the provisions of this subsection. All test results for a lot will be analyzed collectively and statistically by the quality level analysis procedures shown at the end of this subsection to determine the total percent of the lot that is within specification limits and to determine an appropriate pay factor. Lots and sublots are defined in the appropriate subsection of these Specifications for the material being statistically evaluated.

Quality level analysis is a statistical procedure for determining the percent compliance of the material with these Specifications. Quality level is the computed percent of material meeting these Specifications and is determined from the arithmetic mean, ( $\bar{X}_m$ ), and the sample standard deviation ( $S$ ), for each constituent of the lot.

Any necessary rounding off of test results or calculations will be accomplished according to the following rule:

1. The final significant digit will not be changed when the succeeding digit is less than 5.
2. The final significant digit will be increased by one when the succeeding digit is 5 or greater.

##### **1-06.2(2)B Vacant**

##### **1-06.2(2)C Removed and Rejected Materials**

The Contractor may, prior to sampling, elect to remove any defective material and replace it with new material at no expense to the Owner. Any such new material will be sampled, tested, and evaluated for acceptance as a part of the sublot.

The Supervising Contractor may reject a sublot which tests show to be defective. Such rejected material shall not be used in the work, and the results of tests run on the rejected material will not be included in the original lot acceptance tests.

#### **1-06.3 Manufacturer's Certificate of Compliance**

The Supervising Contractor may accept certain materials on the basis of a Manufacturer's Certificate of Compliance as an alternative to material inspection and testing. When a Manufacturer's Certificate of Compliance is authorized by these Specifications or the special provisions, the certification shall be furnished prior to use of the material.

The Contractor may request, in writing, authority from the Supervising Contractor to install such material prior to submitting the required certification; however, no payment will be made for the work in the absence of an acceptable Manufacturer's Certificate of Compliance. The Supervising Contractor reserves the right to deny the request for good cause. If for any reason the Contractor has not provided an acceptable Manufacturer's Certificate of Compliance by the physical completion date established by Section 1-08.5, the Supervising Contractor may process the final payment as provided by Section 1-09.9 without paying for the work performed on such a basis.

The Manufacturer's Certificate of Compliance must identify the manufacturer, the type and quantity of material being certified, the applicable specifications being affirmed, and the signature of a responsible corporate official of the manufacturer and include supporting mill tests or documents. A Manufacturer's Certificate of Compliance shall be furnished with each lot of material delivered to the work and the lot so certified shall be clearly identified in the certificate.

All materials used on the basis of a Manufacturer's Certificate of Compliance may be sampled and tested at any time. Any material not conforming to the requirements will be subject to rejection whether in place or not. The Supervising Contractor reserves the right to refuse to accept materials on the basis of a Manufacturer's Certificate of Compliance.

#### **1-06.4 Handling and Storing Materials**

In storage and handling, the Contractor shall protect materials against damage from careless handling, from exposure to weather, from mixture with foreign matter, and from all other causes. The Supervising Contractor will reject and refuse to test materials improperly handled or stored.

The Contractor shall repair, replace, or make good all Owner-provided materials that are damaged or lost due to the Contractor's operation or while in the Contractor's possession, at no expense to the Owner.

#### **1-06.5 Vacant**

#### **1-06.6 Vacant**

### **1-07 LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC**

#### **1-07.1 Laws to be Observed**

The Contractor shall always comply with all Federal, State, or local laws, ordinances, and regulations that affect work under the contract. The Contractor shall indemnify, defend, and save harmless the State (including the Commission, the Secretary, and any agents, officers, and employees) against any claims that may arise because the Contractor (or any employee of the Contractor or subcontractor or material-person) violated a legal requirement.

The Contractor shall be responsible for the safety of his/her workers and shall comply with safety and health standards such as Safety Standards for Construction Work (Chapter 296-155 WAC), General Safety and Health Standards (Chapter 296-24 WAC), General Occupational Health Standard (Chapter 296-62 WAC), and any other appropriate safety and health codes.

Without usurping the authority of other regulatory agencies, the Owner will cooperate with them in their efforts to enforce legal requirements. On noticing any violation of a legal requirement, the Supervising Contractor will notify the Contractor in an effort to achieve voluntary compliance. The Supervising Contractor may also notify the agency responsible for enforcement if the Supervising Contractor deems that action necessary to achieve compliance with legal requirements. The Supervising Contractor will also help the enforcing agency obtain Contractor compliance to the extent such help is consistent with the provisions of the contract.

The Owner will not adjust payment to compensate the Contractor for changes in legal requirements unless those changes are specifically within the scope of RCW 39.04.120. For changes under RCW 39.04.120, the Owner will compensate the Contractor by negotiated change order as provided in Section 1-04.4.

Under certain conditions, the Owner will adjust payment to compensate for tax changes. First, the changes shall involve federal or state taxes on materials or fuel used in or consumed for the project. Second, the changes shall increase or decrease Contractor-paid taxes by more than \$500. For items in the original contract, the tax change must occur after the bid opening date. For negotiated contracts or items in a supplemental agreement, the tax change must take place after the execution date of the contract or agreement. Within these conditions, the Owner will adjust compensation by the actual dollar amounts of increase or decrease caused by the tax changes. If the Supervising Contractor requests it, the Contractor shall certify in writing that the contract price does not include any extra amount to cover a possible change in taxes.

The Owner may audit the records of the Contractor as provided in Section 1-09.12, to verify any claim for compensation because of changes in laws or taxes.

#### **1-07.2 State Taxes**

The Tacoma Smelter site is being remediated under a Consent Decree issued by the USEPA. Therefore, only supplies and materials used onsite are subject to Washington State sales tax. Unit prices should not include sales tax for labor and services used for environmental remediation. Unit prices shall include applicable B&O taxes.

The Washington State Department of Revenue has issued special rules on the state sales tax. Sections 1-07.2(1) through 1-07.2(3) are meant to clarify those rules. The Contractor should contact the Department of Revenue, Olympia, for answers to questions in this area. The Owner will not adjust its payment if the Contractor bases a bid on a misunderstood tax liability.

The Contractor shall include all Contractor-paid taxes, including Washington State sales tax in the unit bid prices or other contract amounts.

#### **1-07.2(1) Vacant**

#### **1-07.2(2) Vacant**

#### **1-07.2(3) Services**

The Contractor shall not collect retail sales tax from the Owner on any contract wholly for professional or other services (as defined in State Department of Revenue Rules 138 and 224).

#### **1-07.3 Vacant**

#### **1-07.4 Sanitation**

The Contractor shall provide employees with all accommodations required by the State Department of Social and Health Services and other agencies. These accommodations shall be kept clean, neat, and sanitized, and shall not create any public nuisance.

#### **1-07.5 Fish and Wildlife and Ecology Regulations**

##### **1-07.5(1) General**

Throughout the work, the Contractor shall comply with all current rules of the State Departments of Fish and Wildlife, and Ecology. Some, though not all, of these rules are summarized below. Either of these State Departments may, without prejudice to the Owner, add rules as needed to protect game, fish, or the environment.

##### **1-07.5(2) State Department of Fish and Wildlife**

In doing the work, the Contractor shall:

1. Not degrade water in a way that would harm fish. (Criteria: Washington State Water Quality Regulations.)
2. Release any fish stranded by the project into a flowing stream or open water.
3. Replant any stream bank or shoreline area if the project disturbs vegetative cover. Replanted trees, brush, or grasses shall resemble the type and density of surrounding growth, unless the special provisions permit otherwise.
4. Leave, when the work is complete, an open-water channel at the lowest level of any isolated pothole to connect it with the main body of water.
5. Prevent any fish-threatening silt buildup on the bed or bottom of any body of water.
6. Never block stream flow or fish passage.
7. Keep all equipment out of any flowing stream or other body of water, except as may be permitted by the special provisions.
8. Never remove gravel or other bottom material from the high-water-flow channel bed of any stream or from the bottom of any other body of water, except as may be permitted by the special provisions.
9. Dispose of any project debris by removal, burning, or placement above high-water flows.

If the work in (1) through (3) above differs little from what the contract requires, the Owner will measure and pay for it at unit contract prices. But if contract items do not cover those areas, the Owner will pay pursuant to Section 1-09.4. Work in (4) through (9) above will be incidental to contract pay items.

##### **1-07.5(3) State Department of Ecology**

In doing the work, the Contractor shall:

1. Get a waste discharge permit from the Ecology Department before:
  - a. Washing aggregate; and

- b. Discharging water from pit sites or excavations into a ground or surface waterway when the water contains turbidity, silt, or foreign materials.
2. Give the Supervising Contractor a copy of each waste discharge permit before the work begins.
3. Control drainage and erosion to reduce waterway pollution.
4. Dispose of, in ways that will prevent their entry into State waters, all:
  - a. Toxicants (including creosote, oil, cement, concrete, and equipment wash water); and
  - b. Debris, overburden, and other waste materials.
5. Notify the Ecology Department immediately should oil, chemicals, or sewage spill into State waters.

#### **1-07.5(4) Air Quality**

The Contractor shall comply with all rules of local air pollution authorities. If there are none, air-quality rules of the State Department of Ecology shall govern the work.

The Washington Clean Air Act requires that rock crushing, rock drilling, asphalt batch plants, and concrete plants receive an air quality permit in advance of the operation. The air quality permit process may include additional State Environment Policy Act (SEPA) requirements. Contractors or operators should contact the appropriate air pollution control authority well in advance of intended start-up. The permit process may require up to 30 days.

#### **1-07.6 Permits and Licenses**

Contractors shall obtain all required permits and licenses and give any notices these call for. The Owner will support the Contractor in efforts to obtain a temporary operating permit in its name if:

1. A local rule or an agency policy prevent issuing the permit to a private firm;
2. The Contractor takes all action to obtain the permit;
3. The permit will serve the public interest;
4. The permit applies only to work under the contract;
5. The Contractor agrees in writing: (a) to comply with all the issuing agency requires, and (b) to hold the Owner harmless for any work-related liability incurred under the permit; and
6. The permit costs the Owner nothing.

#### **1-07.7 Load Limits**

##### **1-07.7(1) General**

While moving equipment or materials on any public highway, the Contractor shall comply with all laws that control traffic or limit loads. The contract neither exempts the Contractor from such laws nor licenses overloads. At the Supervising Contractor's request, the Contractor shall provide any facts needed to compute the equipment's weight on the roadway.

Elsewhere on the project, the Contractor may operate equipment with only the load-limit restrictions in 1, 2, and 3 in Section 1-07.7(2). The Contractor shall remain responsible, however, for all load-caused damage. All vehicles subject to license on a tonnage basis shall be licensed to maximum legal capacity before operating under these limits.

If necessary and safe to do so, and if the Contractor requests it in writing, the Supervising Contractor may approve higher load limits than those in the load-limit restrictions in 1, 2, and 3 in Section 1-07.7(2). The written request shall:

1. Describe loading details;
2. Describe the arrangement, movement, and position of equipment on the structure or over culverts and pipes; and
3. State that the Contractor assumes all risk for damage.

Unit prices shall cover all costs for operating over bridges and culverts. Nothing in this section affects the Contractor's other responsibilities under these Specifications or under public highway laws.

##### **1-07.7(2) Load-Limit Restrictions**

1. **Structures Designed for Direct Bearing of Live Loads.** The gross or maximum load on each vehicle axle shall not exceed the legal load limit by more than 35 percent. No more than one vehicle shall operate over any structure at one time. The Contractor shall immediately remove any dirt, rock, or debris that may gather on the structure's roadway surface.
2. **Underpasses and Reinforced Concrete Box Culverts Under Embankments.** Loads shall not exceed 24,000 pounds on a single axle and 16,000 pounds each on tandem axles spaced less than 10 feet apart. These limits are permitted only if the embankment has: (a) been built to specifications, and (b) reached at least 3 feet above the top of the underpass or culvert.

When the embankment has reached 5 feet above the top of the underpass or culvert, the Contractor may increase per-axle loads up to 100,000 pounds if outside wheel spacing is at least 7 feet on axle centers.

3. Pipe Culverts and Sewer Pipes. Loads over pipe culverts and sewer pipes shall not exceed 24,000 pounds on a single axle and 16,000 pounds each on tandem axles spaced less than 10 feet apart. These limits are permitted only if: (a) the culvert or pipe has been installed and backfilled to specifications, and (b) the embankment has reached at least 2 feet above the top limit of pipe compaction, as defined in Design A or Design C.

When the embankment has reached 5 feet above the top limit of pipe compaction, the Contractor may increase per-axle loads up to 100,000 pounds if outside wheel spacing is at least 7 feet on axle centers, except that:

- a. For Class III reinforced concrete pipes, the embankment shall have risen above the top limit of compaction at least: (1) 6 feet for Design A work, and (2) 7 feet for Design C work.
- b. For Class II reinforced concrete pipes, the maximum load for each axle shall be 80,000 pounds if outside wheel spacing is at least 7 feet on axle centers. In this case, the embankment shall have risen above the top limit of compaction at least: (1) 6 feet for Design A work, and (2) 10 feet for Design C work.

#### **1-07.8 High Visibility Apparel**

The Contractor shall require all personnel at the work site under their control (including subcontractors and lower tier subcontractors) to comply with the following:

1. To wear reflective vests, except that during daylight hours, orange clothing equivalent to "Ten Mile Cloth" or hunter orange may be worn in lieu of reflective vests;
2. To wear white coveralls at night;
3. Whenever rain gear is worn during hours of darkness, it shall be white or yellow; and
4. The reflective vests shall always be the outermost garment.

Exceptions to these requirements are: (1) when personnel are out of view of and not exposed to traffic, (2) when personnel are inside a vehicle, or (3) where it is obvious that such apparel is not needed for the employees safety from traffic.

Reflective vests shall have a minimum of 100 square inches of reflective surface distributed 30 percent on the front and 70 percent on the back. The retroreflection value at an entrance angle of -4 degrees and an observation angle of 0.2 degrees shall be a minimum 500 candle power for the reflective surface of the vest.

Reflective vests, hard hats, white coveralls, rain gear, and other apparel shall be furnished and maintained in a neat, clean, and presentable condition at no expense to the Owner.

#### **1-07.9 Wages**

##### **1-07.9(1) Audits**

The Owner may inspect or audit the Contractor's wage and payroll records as provided in Section 1-09.12.

##### **1-07.10 Worker's Benefits**

The Contractor shall make all payments required for unemployment compensation under Title 50 RCW and for industrial insurance and medical aid required under Title 51 RCW. If any payment required by Title 50 or Title 51 is not made when due, the Owner may retain such payments from any money due the Contractor and pay the same into the appropriate fund. Such payment will be made only after giving the Contractor 15 days prior written notice of the Owner's intent to disburse the funds to the Washington State Department of Labor and Industries or Washington State Employment Security Department as applicable. The payment will be made upon expiration of the 15 calendar day period if no legal action has been commenced to resolve the validity of the claim. If legal action is instituted to determine the validity of the claim prior to the expiration of the 15-day period, the Owner will hold the funds until determination of the action or written settlement agreement of the appropriate parties.

For work on or adjacent to water, the Contractor shall make the determination as to whether workers are to be covered under the Longshoremen's and Harbor Worker's Compensation Act administered by the U.S. Department of Labor, or the State Industrial Insurance coverage administered by the Washington State Department of Labor and Industries.

The Contractor shall include in the various items in the bid proposal all costs for payment of unemployment compensation and for providing either or both of the insurance coverages. The Contractor will not be entitled to any additional payment for: (1) failure to include such costs, or (2) determinations made by the U.S. Department of Labor or the Washington State Department of Labor and Industries regarding the insurance coverage.



The Public Works Contract Division of the Washington State Department of Labor and Industries will provide the Contractor with applicable industrial insurance and medical aid classification and premium rates. After physical completion of the project, the Contractor shall submit a "Request for Release" to the Washington State Department of Labor and Industries on the form they provide. The "Request for Release" form is for the purpose of obtaining a release with respect to the payments of industrial insurance and medical aid premiums.

#### **1-07.11 Equal Employment Opportunity Responsibilities**

The Contractor shall comply with all State laws and regulations which are in effect pertaining to nondiscrimination. In addition, on contracts financed in whole or in part with Federal funds, the Contractor shall comply with all Federal laws and regulations which are in effect.

##### **1-07.11(1) General**

The Contractor and all subcontractors or lower tier subcontractors (not including material suppliers) holding subcontracts of \$10,000 or more shall comply with the following minimum specific requirement activities of equal employment opportunity. The Contractor shall include these requirements in every subcontract of \$10,000 or more with such modification of language as is necessary to make them binding on the subcontractor or the lower tier subcontractors.

##### **1-07.11(2) Equal Employment Opportunity Policy**

The Contractor shall accept as an operating policy the following statement which is designed to further the provision of equal employment opportunity to all persons without regard to their race, color, religion, sex, national origin, age, or disability, and to promote the full realization of equal employment opportunity through a positive continuing program:

It is the policy of this Company to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age, or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training.

##### **1-07.11(3) Equal Employment Opportunity Officer**

The Contractor shall officially designate and make known to the Supervising Contractor during the pre-construction meetings and discussions the firm's Equal Employment Opportunity Officer (hereinafter referred to as the EEO Officer). The EEO Officer will also be responsible for making him/herself known to each of the Contractor's employees. The EEO Officer must possess the responsibility, authority, and capability for administering and promoting an active and effective Contractor program of equal employment opportunity.

##### **1-07.11(4) Vacant**

##### **1-07.12 Vacant**

#### **1-07.13 Contractor's Responsibility for Work**

##### **1-07.13(1) General**

All work and material for the contract, including any change order work, shall be at the sole risk of the Contractor until the entire improvement has been completed as determined by the Supervising Contractor, except as provided in this section.

The Contractor shall rebuild, repair, restore, and make good all damages to any portion of the permanent or temporary work occurring before the physical completion date and shall bear all the expense to do so, except damage to the permanent work caused by: (a) acts of God, such as earthquake, floods, or other cataclysmic phenomenon of nature, or (b) acts of the public enemy or of governmental authorities; or (c) slides in cases where Section 2-03.3(11) is applicable; Provided, however, that these exceptions shall not apply should damages result from the Contractor's failure to take reasonable precautions or to exercise sound engineering and construction practices in conducting the work.

If the performance of the work is delayed as a result of damage by others, an extension of time will be evaluated in accordance with Section 1-08.8.

Nothing contained in this section shall be construed as relieving the Contractor of responsibility for, or damage resulting from, the Contractor's operations or negligence, nor shall the Contractor be relieved from full responsibility for making good any defective work or materials as provided for under Section 1-05.

##### **1-07.13(2) Relief of Responsibility for Completed Work**

Upon written request, the Contractor may be relieved of the duty of maintaining and protecting certain portions of the work, as described below, which have been completed in all respects in accordance with the requirements of the contract. If the Supervising Contractor provides written approval, the Contractor will be relieved of the responsibility for damage to said completed portions of the

work resulting from use by public traffic or from the action of the elements or from any other cause, but not from damage resulting from the Contractor's operations or negligence.

#### **1-07.13(3) Vacant**

#### **1-07.13(4) Repair of Damage**

The Contractor shall promptly repair all damage to either temporary or permanent work as directed by the Supervising Contractor. For damage qualifying for relief under Sections 1-07.13(1), 1-07.13(2), or 1-07.13(3), payment will be made in accordance with Section 1-04.4. Payment will be limited to repair of damaged work only. No payment will be made for delay or disruption to the work.

The Supervising Contractor may elect to accomplish repair by Owner forces or other means.

#### **1-07.14 Responsibility for Damage**

The Owner, Supervising Contractor, and their employees will not be responsible in any manner: for any loss or damage that may happen to the work or any part; for any loss of material or damage to any of the materials or other things used or employed in the performance of work; for injury to or death of any persons, either workers or the public; or for damage to the public for any cause which might have been prevented by the Contractor, or the workers, or anyone employed by the Contractor.

The Contractor shall be responsible for any liability imposed by law for injuries to, or the death of, any persons or damages to property resulting from any cause whatsoever during the performance of the work, or before final acceptance.

The Contractor shall bear sole responsibility for damage to completed portions of the project and to property located off the project caused by erosion, siltation, run-off, or other related items during the construction of the project. The Contractor shall also bear sole responsibility for any pollution of rivers, streams, ground water, or other waters which may occur as a result of construction operations. The Contractor shall exercise all necessary precautions throughout the life of the project to prevent pollution, erosion, siltation, and damage to property.

The Contractor shall be responsible, and reimburse the Owner, for any loss or expense to the Owner arising from damage to the work or other property of the Owner caused by the wrongful act or neglect of the Contractor, any Subcontractor or of the employees of the Contractor or any Subcontractor. Where such damage includes damage to the work it shall be repaired at the expense of the Contractor.

The Owner shall be responsible for all damage to the work, including all materials and equipment owned by the Owner on or about the premises intended for permanent use in the project or incidental to the construction thereof and included in the total cost of the work except when the same are proximately caused by any act, omission or negligence of the Contractor, its Subcontractor(s) or their agents, employees or representatives.

The Owner may during the process of the work, maintain and pay for property insurance to cover the work during construction with such deductible as it may at its sole discretion choose or Owner may at its sole option completely self-insure same.

If the Contractor desires any other insurance, beyond that provided by Owner, to protect Contractor's temporary structures, materials, hand tools, machinery and equipment he may obtain and pay for same.

#### **1-07.15 Temporary Water Pollution/Erosion Control**

This work consists of temporary measures shown in the plans, specified in the special provisions, proposed by the Contractor and approved by the Supervising Contractor, or ordered by the Supervising Contractor as work proceeds. This work is intended to prevent, control, and stop water pollution or erosion within the project, thereby protecting the work, nearby land, streams, and other bodies of water.

Controlling pollution, erosion, run-off, and related damage may require the Contractor to perform temporary work items including but not limited to:

1. Providing ditches, berms, culverts, and other measures to control surface water;
2. Building dams, settling basins, energy dissipaters, and other measures, to control downstream flows;
3. Controlling underground water found during construction; or
4. Covering or otherwise protecting slopes until permanent erosion-control measures are working.

Before any work begins, the Contractor shall obtain the Supervising Contractor's approval on a plan for temporary water pollution/erosion control. The plan shall show the schedule for all erosion-control work, whether permanent as required by the contract or temporary as proposed by the Contractor. The plan shall cover all areas the Contractor's work may affect inside and outside the limits of the project (including all Owner-provided sources, disposal sites, and haul roads, and all nearby land, streams, and other bodies of water). Before this plan has been approved, the Contractor shall do no clearing and grubbing or earthwork unless the

Supervising Contractor approves in writing. The Contractor shall revise and update the plan whenever the Supervising Contractor so requests in writing.

The Contractor shall allow at least five working days for the Supervising Contractor's review of any original or revised plan. Failure to approve all or part of any such plan shall not make the Owner liable to the Contractor for any work delays.

To the degree possible, the Contractor shall coordinate this temporary work with permanent drainage and erosion control work the contract requires.

If the Supervising Contractor, under Section 1-08.6, orders the work suspended for an extended time, the Contractor shall, before the Owner assumes maintenance responsibility, make every effort to control erosion, pollution, and run-off during shutdown.

#### **1-07.16 Protection and Restoration of Property**

##### **1-07.16(1) Private/Public Property**

The Contractor shall protect private or public property on or in the vicinity of the work site. The Contractor shall ensure that it is not removed, damaged, destroyed, or prevented from being used unless the contract so specifies.

Property includes land, utilities, trees, landscaping, improvements legally on the right-of-way, markers, monuments, buildings, structures, pipe, conduit, sewer or water lines, signs, and other property of all description whether shown on the plans or not.

If the Supervising Contractor requests in writing, or if otherwise necessary, the Contractor shall install protection, acceptable to the Supervising Contractor, for property such as that listed in the previous paragraph. The Contractor is responsible for locating all property that is subject to damage by the construction operation.

If the Contractor (or agents/employees of the Contractor) damage, destroy, or interfere with the use of such property, the Contractor shall restore it to original condition. The Contractor shall also halt any interference with the property's use. If the Contractor refuses or does not respond immediately, the Supervising Contractor may have such property restored by other means and subtract the cost from money that will be or is due the Contractor.

##### **1-07.16(2) Vacant**

##### **1-07.16(3) Fences, Mailboxes, Incidentals**

The Contractor shall maintain any temporary fencing to preserve livestock, crops, or property when working through or adjacent to private property. The Contractor is liable for all damages resulting from not complying with this requirement.

The usefulness of existing mail or paper boxes shall not be impaired. If the contract anticipates removing and reinstalling the mail or paper boxes, the provisions of Section 8-18 will apply. If the mail or paper boxes are rendered useless solely by acts (or inaction) of the Contractor or for the convenience of the Contractor, the work shall be performed as provided in Section 8-18 at the Contractor's expense.

##### **1-07.16(4) Payment**

All costs to comply with this section and for the protection and repair specified in this section are incidental to the contract and are the responsibility of the Contractor. The Contractor shall include all related costs in the unit bid prices of the contract.

#### **1-07.17 Utilities and Similar Facilities**

The Contractor shall protect all private and public utilities from damage resulting from the work. Among others, these utilities include: telephone, telegraph, and power lines; sewer and water lines; railroad tracks and equipment; and highway lighting and signing systems.

If the work requires removing or relocating a utility, the contract will assign the task to the Contractor or the utility owner. When this task is assigned to the utility owner and work is not complete before the Contractor begins work, the Contractor shall immediately notify the Supervising Contractor in writing.

Any authorized agent of the Owner or utility owners may enter to repair, rearrange, alter, or connect their equipment. The Contractor shall cooperate with such efforts and shall avoid creating delays or hindrances to those doing the work. As needed, the Contractor shall arrange to coordinate work schedules.

To ease or streamline the work, the Contractor may desire to ask utility owners to move, remove, or alter their equipment in ways other than those listed in the plans or special provisions. The Contractor shall make the arrangements and pay all costs that arise from them.

In some cases, the Plans or special provisions may not show all underground facilities. If the work requires these to be moved, the Supervising Contractor will provide for other forces to move them or issue a written change order requiring the Contractor to do so as provided in Section 1-04.4.

All costs required to protect public and private utilities as provided in this section shall be at the Contractor's expense. When others delay the work through late removal or relocation of any utility or similar facility, the Contractor's loss of time will be adjusted by extending contract time in keeping with Section 1-08.8.

If the contract provides notice that utilities will be adjusted, relocated, replaced, or constructed during the prosecution of the work, the Contractor shall carry out the work in a way that will minimize interference and delay for all forces involved. Any costs resulting from the coordination and prosecution of the work regarding utility adjustment, relocation, replacement, or construction shall be at the Contractor's expense as provided in Section 1-05.14.

The existence and approximate location of underground utilities or similar facilities will be indicated in the plans insofar as it is possible to do so. The existence and approximate locations will be determined by a search of available records; however, additional utilities may be encountered and the locations of the utilities indicated therein may vary from the actual locations of the utilities as indicated. The Contractor shall take the necessary precautionary measures to protect the existing utilities and structures indicated and any of the utilities or structures which may be encountered at the site during construction. Failure of the Owner to show the existence of subsurface objects or facilities on the plans shall not relieve the Contractor from the responsibility to make an independent surface check of the project site, nor relieve the Contractor from all liability for damages resulting from the Contractor's operations.

The utilities in Pierce County work together in a Council to help prevent accidents and damages to underground facilities. One telephone call to 1-800-424-5555, 48 hours prior to digging (excluding weekends and holidays) will relay a message to these utilities, as necessary. These agencies will give assistance in the location of the various utilities, but such assistance shall not relieve the Contractor from the responsibility for damage incurred, except where the installations are not located as closely as is normally possible with an electronic pipe locator or meet the additional exception criteria listed herein.

Existing underground utilities, whether public or private, which are damaged by the Contractor, will be repaired by the utility owner. The Contractor shall be liable for all costs resulting from the damage to a utility if:

1. The utility system is in a standard location adopted by the local jurisdiction, or is indicated in the Plans, and the actual location of any portion of the utility is within 24 inches horizontally of the standard location, or the location indicated on the Plans, or
2. The utility has field located and marked its facilities and the actual location of any portion of the utility is within 24 inches horizontally of said location mark, or
3. The utility system is visible or has become visible or can be reasonably assumed to exist at the location due to visible evidence prior to the damage, or
4. The Contractor has failed to provide the required notification to the utility owner of the utility that has been damaged.

The depth of the utility, if indicated, is for the Contractor's convenience only, and the Contractor's responsibility for damage as specified above shall not be altered due to the actual depth being different or other than that indicated on the plans.

The Contractor shall notify the proper utility immediately upon break or damage to any utility line or appurtenance, or the interruption of their service. He shall notify the proper utility when his operations may affect the service or cause damage to the utility involved.

Any loss of time suffered by the Contractor due to delay and removal or relocation of any utility or other facility by others may be adjusted in accordance with Section 1-08.8 permitting extensions of time.

#### **1-07.18 Vacant**

#### **1-07.19 Vacant**

#### **1-07.20 Patented Devices, Materials, and Processes**

The Contractor shall assume all costs arising from the use of patented devices, materials, or processes used on or incorporated in the work, and agrees to indemnify, defend, and save harmless the State, Commission, Secretary, and their duly authorized agents and employees from all actions of any nature for, or on account of the use of any patented devices, materials, or processes.

#### **1-07.21 Rock Drilling Safety Requirements**

It shall be the Contractor's responsibility to maintain safe working conditions during rock drilling, by keeping dust concentration below the threshold limit value or by providing those protective devices that may be required by the State Department of Labor and Industries.

#### **1-07.22 Use of Explosives**

Explosives shall not be used on this project.

#### **1-07.23 Public Convenience and Safety**

##### **1-07.23(1) Construction Under Traffic**

The Contractor shall conduct all operations with the least possible obstruction and inconvenience to the public. The Contractor shall have under construction no greater length or amount of work than can be prosecuted properly with due regards to the rights of the public. To the extent possible, the Contractor shall finish each section before beginning work on the next.

To disrupt public traffic as little as possible, the Contractor shall:

1. Permit traffic to pass through the work with the least possible inconvenience or delay;
2. Maintain existing roads and streets within the project limits, keeping them open, and in good, clean, safe condition at all times. Deficiencies caused by the Contractor's operations shall be repaired at the Contractor's expense. Deficiencies not caused by the Contractor's operations shall be repaired by the Contractor when directed by the Supervising Contractor, at the Owner's expense. The Contractor shall also maintain roads and streets adjacent to the project limits when affected by the Contractor's operations. Snow and ice control will be performed by the Owner on all projects. Cleanup of snow and ice control debris will be at the Owner's expense;
3. Remove or repair any condition resulting from the work that might impede traffic or create a hazard;
4. Keep existing traffic signal and highway lighting systems in operation as the work proceeds. (The Owner will continue the routine maintenance on such systems.)
5. Maintain the striping on the roadway at the Owner's expense. The Contractor shall be responsible for scheduling when to renew striping, subject to the approval of the Supervising Contractor. When the scope of the project does not require work on the roadway, the Owner will be responsible for maintaining the striping;
6. Maintain existing permanent signing. Repair of signs will be at the Owner's expense, except those damaged due to the Contractor's operations; and
7. Keep drainage structures clean to allow for free flow of water. Cleaning of existing drainage structures will be at the Owner's expense when approved by the Supervising Contractor, except when flow is impaired due to the Contractor's operations.

To protect the rights of abutting property owners, the Contractor shall:

1. Conduct the construction so that the least inconvenience as possible is caused to abutting property owners;
2. Maintain ready access to driveways, houses, and buildings along the line of work;
3. Provide temporary approaches to crossing or intersecting roads and keep these approaches in good condition; and
4. Provide another access before closing an existing one whenever the contract calls for removing and replacing an abutting owner's access.

When traffic must pass through grading areas, the Contractor shall:

1. Make cuts and fills that provide a reasonably smooth, even roadbed;
2. Place, in advance of other grading work, enough fill at all culverts and bridges to permit traffic to cross;
3. Make roadway cuts and fills, if ordered by the Supervising Contractor, in partial-width lifts, alternating lifts from side to side to permit traffic to pass on the side opposite the work;
4. Install culverts on half the width of the traveled way, keeping the other half open to traffic and unobstructed until the first half is ready for use;
5. After rough grading or placing any subsequent layers, prepare the final roadbed to a smooth, even surface (free of humps and dips) suitable for use by public traffic; and
6. Settle dust with water, or other dust palliative, as the Supervising Contractor may order.

If grading work is on or next to a roadway in use, the Contractor shall finish the grade immediately after rough grading and place surfacing materials as the work proceeds.

The Contractor shall conduct all operations to minimize any drop-offs (abrupt changes in roadway elevation) left exposed to traffic during non-working hours. Unless otherwise specified in the Traffic Control Plan, drop-offs left exposed to traffic during non-working hours shall be protected as follows:

1. Drop-offs up to 0.20 foot, unless otherwise ordered by the Supervising Contractor, may remain exposed with appropriate warning signs alerting motorists of the condition.
2. Drop-offs more than 0.20 foot that are in the traveled way or auxiliary lane will not be allowed unless protected with appropriate warning signs and further protected as indicated in 3b or 3c below.

3. Drop-offs more than 0.20 foot, but no more than 0.50 foot, that are not within the traveled way shall be protected with appropriate warning signs and further protected by having one of the following:
  - a. A wedge of compacted stable material placed at a slope of 4:1 or flatter.
  - b. Channelizing devices (Type I barricades, plastic safety drums, or other devices 36 inches or more in height) placed along the traffic side of the drop-off and a new edge of pavement stripes placed a minimum of 3 feet from the drop-off. The maximum spacing between the devices in feet shall be the posted speed in miles per hour. Pavement drop-off warning signs shall be placed in advance and throughout the drop-off treatment.
  - c. Temporary concrete barrier or other approved barrier installed on the traffic side of the drop-off with 1 foot between the drop-off and the back of the barrier and a new edge of pavement stripe a minimum of 2 feet from the face of the barrier. An approved terminal, flare, or impact attenuator will be required at the beginning of the section. For night use, the barrier shall have standard delineation such as paint, reflective tape, lane markers, or warning lights.
4. Drop-offs more than 0.50 foot not within the traveled way or auxiliary lane shall be protected with appropriate warning signs and further protected as indicated in 3a, 3b, or 3c if all of the following conditions are met:
  - a. The drop-off is less than 2 feet;
  - b. The total length throughout the project is less than 1 mile;
  - c. The drop-off does not remain for more than three working days;
  - d. The drop-off is not present on any of the holidays listed in Section 1-08.5; and
  - e. The drop-off is only on one side of the roadway.
5. Drop-offs more than 0.50 foot that are not within the traveled way or auxiliary lane and are not otherwise covered by No. 4 above shall be protected with appropriate warning signs and further protected as indicated in 3a or 3c.
6. Open trenches within the traveled way or auxiliary lane shall have a steel-plate cover placed and anchored over them. A wedge of suitable material, if required, shall be placed for a smooth transition between the pavement and the steel plate. Warning signs shall be used to alert motorists of the presence of the steel plates.

The Contractor shall be responsible for providing adequate safeguards, safety devices, protective equipment, and any other needed actions to protect the life, health, and safety of the public, and to protect property in connection with the performance of the work covered by the contract. The Contractor shall perform any measures or actions the Supervising Contractor may deem necessary to protect the public and property. The responsibility and expense to provide this protection shall be the Contractor's except that which is to be furnished by the Owner as specified in other sections of these Specifications. Nothing contained in this contract is intended to create any third-party beneficiary rights in favor of the public or any individual utilizing the highway facilities being constructed or improved under this contract.

#### **1-07.23(2) Construction and Maintenance of Detours**

Unless otherwise approved, the Contractor shall maintain two-way traffic during construction. The Contractor shall build, maintain in a safe condition, keep open to traffic, and remove when no longer needed:

1. Detours and detour bridges that will accommodate traffic diverted from the roadway or bridge during construction,
2. Detour crossings of intersecting highways, and
3. Temporary approaches.

Unit contract prices will cover construction, maintenance, and removal of all detours shown in the plans or proposed by the Owner.

The Contractor shall pay all costs to build, maintain, and remove any other detours, whether built for the Contractor's convenience or to facilitate construction operations. Any detour proposed by the Contractor shall not be built until the Supervising Contractor approves. Surfacing and paving shall be consistent with traffic requirements.

Upon failure of the Contractor to immediately provide, maintain, or remove detours or detour bridges when ordered to do so by the Supervising Contractor, the Owner may, without further notice to the Contractor or the Surety, provide, maintain, or remove the detours or detour bridges and deduct the costs from any payments due or coming due the Contractor.

#### **1-07.24 Rights of Way**

All rights of way for the completed facility will be provided by the Owner in advance of construction. Any exceptions will be noted in the special provisions. Should the necessary right of way not be available as provided in the contract, an extension of time will be considered in accordance with Section 1-08.8.

#### **1-07.25 Opening of Sections to Traffic**

The Owner reserves the right to use and open to traffic any portion of the work before the physical completion date of the entire contract without constituting acceptance of any of the work. This action will not cause the Owner to incur any liability to the Contractor except as may otherwise be provided in the contract.

If the Owner opens any portion of the work prior to the physical completion date of the entire contract because early opening is specified in the contract or when the Contractor has failed to prosecute the work continuously and efficiently, any work remaining shall

be performed by the Contractor at the unit contract prices for the items of work involved. No additional payment will be made for costs incurred by the Contractor because of: (1) inconvenience, additional length of travel to conform to established traffic patterns and planned access features; (2) compliance with statutes governing traffic regulations and limitations of loads; or (3) additional flagging costs necessary to protect the operations and the traveling public. The Contractor shall take all costs due to traffic using portions of the work into account when submitting the bid proposal, and the unit contract prices for the various items of work involved shall include these costs.

If such prior use increases the cost of or delays the work, the Contractor shall be entitled to extra compensation in reimbursement thereof, or extension of time equal to the delay or both, as the parties may agree upon, and failing agreement the dispute shall be determined by arbitration.

#### **1-07.26 Personal Liability of Public Officers**

Neither the Owner or Supervising Contractor, nor any employee shall be personally liable for any acts or failure to act in connection with the contract, it being understood that in such matters, they are acting solely as agents of the State.

#### **1-07.27 No Waiver of Owner's Legal Rights**

The Owner shall not be precluded or be stopped by any measurement, estimate, or certificate made either before or after the completion and acceptance of the work and payment therefor from showing the true amount and character of the work performed and materials furnished by the Contractor, or from showing that any such measurement, estimate, or certificate is untrue or incorrectly made, or that the work or materials do not conform in fact to the contract. The Owner shall not be precluded or be stopped, notwithstanding any such measurement, estimate, or certificate, and payment in accordance therewith, from recovering from the Contractor and the Sureties such damages as it may sustain by reason of the Contractor's failure to comply with the terms of the contract. Neither the acceptance by the Secretary, nor any payment for the whole or any part of the work, nor any extension of time, nor any possession taken by the Owner shall operate as a waiver of any portion of the contract or of any power herein reserved or any right to damages herein provided, or bar recovery of any money wrongfully or erroneously paid to the Contractor. A waiver of any breach of the contract shall not be held to be a waiver of any other or subsequent breach.

The Contractor and the Owner recognize that the impact of overcharges to the Owner by the Contractor resulting from antitrust law violations by the Contractor's suppliers or subcontractors adversely affects the Owner rather than the Contractor. Therefore, the Contractor agrees to assign to the Owner any and all claims for such overcharges.

#### **1-07.28 Protection of the Environment**

##### **1-07.28(1) General**

There is a possibility of elevated concentrations of metals in the off-site and on-site soil materials. The following provisions and those found elsewhere in these Specifications shall be strictly adhered to. The Contractor shall fully cooperate with the Owner, Supervising Contractor, and regulatory personnel to assure that all applicable environmental protection and safety requirements are met. Unless specifically provided for otherwise, such activities shall be considered incidental to the work and no separate payment shall be made.

##### **1-07.28(2) Environmental Pollution**

The Contractor shall maintain all work areas within and outside the project boundaries free from environmental pollution which would be in violation to any federal, state, or local regulations.

##### **1-07.28(3) Protection of Waterways**

The Contractor shall observe the rules and regulations of the State of Washington and agencies of the United States Government prohibiting the pollution of stream or river waters by the dumping of any refuse, rubbish, or debris therein.

##### **1-07.28(4) Protection of Air Quality**

The Contractor shall not discharge smoke, dust or other contaminants into the atmosphere that violate the regulations of any legally constituted authority.

The Contractor shall furnish all labor, equipment, and means required and shall carry out effective measures wherever and as often as necessary in the opinion of the Supervising Contractor to prevent his operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity.

The Contractor shall comply with specific requirements of air quality control laws.

The Contractor shall be responsible for any damage resulting from any dust originating from his operations.

The dust abatement measures shall be continued until the Contractor is relieved of further responsibility by the Owner.

If temporary heating devices are necessary for protection of the work, such devices shall be of an approved type that will not cause pollution of the air.

## **1-08 PROSECUTION AND PROGRESS**

### **1-08.1 Subcontracting**

The Contractor shall not subcontract work unless the Supervising Contractor approves in writing. Each request to subcontract shall be on the form the Supervising Contractor provides. If the Supervising Contractor requests, the Contractor shall provide proof that the subcontractor has the experience, ability, and equipment the work requires. The Contractor shall require each subcontractor to furnish all certificates and statements required by the contract.

The Supervising Contractor will approve the request only if satisfied with the proposed subcontractor's record, equipment, experience, and ability. Approval to subcontract shall not:

1. Relieve the Contractor of any responsibility to carry out the contract,
2. Relieve the Contractor of any obligations or liability under the contract and the Contractor's bond,
3. Create any contract between the Owner and the subcontractor, or
4. Convey to the subcontractor any rights against the Owner.

The Owner will not consider as subcontracting: (1) purchase of sand, gravel, crushed stone, crushed slag, batched concrete aggregates, ready mix concrete, off-site fabricated structural steel, other off-site fabricated items, and any other materials supplied by established and recognized commercial plants; or (2) delivery of these materials to the work site in vehicles owned or operated by such plants or by recognized independent or commercial hauling companies.

If dissatisfied with any part of the subcontracted work, the Supervising Contractor may request in writing that the subcontractor be removed. The Contractor shall comply with this request at once and shall not employ the subcontractor for any further work under the contract.

The Contractor shall, as soon as practicable after the execution of this Contract, notify the Owner in writing of the names of any Subcontractors proposed to be employed in any part of the work and shall not employ any such Subcontractor without the prior approval of the Owner in writing and shall terminate the employment of any which the Owner may at any time object to as incompetent or unfit.

The Contractor agrees to require each Subcontractor to execute a contract in writing binding such Subcontractor to the terms of this Contract insofar as applicable to his work, and requiring such Subcontractor, to the extent applicable, to assume toward the Contractor all the obligations and responsibilities that the Contractor assumes toward the Owner, unless specifically noted to the contrary in a written subcontract approved in writing by the Owner.

The Contractor shall be fully responsible to the Owner for the acts and omissions of all Subcontractors and of persons directly or indirectly employed by them. Nothing in this Contract shall create any contractual relationship between any Subcontractor and the Owner.

The word "Subcontractor", as employed herein, shall mean one having a direct contract with the Contractor, including one who furnished material worked to a special design according to the plans or specifications of this work, but excluding one who merely furnished material not so worked.

### **1-08.2 Vacant**

### **1-08.3 Progress Schedule**

The Contractor shall submit a preliminary progress schedule (first 60 working days) to the Supervising Contractor no later than five calendar days after the date the contract is executed. This preliminary schedule shall show work to be performed during the first 60 working days of the contract.

The Contractor shall submit five copies of the progress schedule (total working days) to the Supervising Contractor no later than 30 calendar days after the date the contract is executed. This schedule and any supplemental schedule shall show: (1) physical completion of all work within the specified contract time, (2) the proposed order of work, and (3) projected starting and completion times for major phases of the work and for the total project. The schedule shall be developed by a critical path method. The Contractor shall provide sufficient material, equipment, and labor to meet the completion times in this schedule.

The Owner allocates its resources to a contract based on the total time allowed in the contract. The Owner will accept a progress schedule indicating an early physical completion date but cannot guarantee the Owner's resources will be available to meet the



accelerated schedule. No additional compensation will be allowed if the Contractor is not able to meet their accelerated schedule due to the unavailability of Owner's resources or for other reasons beyond the Owner's control.

The Contractor shall submit supplemental progress schedules when requested by the Supervising Contractor or as required by any provision of the contract. These supplemental schedules shall reflect any changes in the proposed order of the work, any construction delays, or other conditions that may affect the progress of the work. The Contractor shall provide the Supervising Contractor with the supplemental progress schedules within ten calendar days of receiving written notice of the request.

The original and all supplemental progress schedules shall not conflict with any time and order-of-work requirement in the contract.

If the Supervising Contractor deems that the original or any necessary supplemental progress schedule does not provide the information required in this section, the Owner may withhold progress payments until a schedule containing the required information has been submitted by the Contractor and approved by the Supervising Contractor.

The Supervising Contractor's approval of any schedule shall not transfer any of the Contractor's responsibilities to the Owner. The Contractor alone shall remain responsible for adjusting forces, equipment, and work schedules to ensure completion of the work within the time(s) specified in the contract.

A pre-construction conference shall be held within 10 days after the contract has been awarded but before the start of construction.

#### **1-08.4 Prosecution of Work**

The Contractor shall begin work within on the date agreed to in the contract, unless otherwise approved in writing. The Contractor shall diligently pursue the work to the physical completion date within the time specified in the contract. Voluntary shutdown or slowing of operations by the Contractor shall not relieve the Contractor of the responsibility to complete the work within the time(s) specified in the contract.

#### **1-08.5 Time for Completion**

The Contractor shall complete all physical contract work according to the schedule agreed to in the contract.

A non-working day is defined as a Saturday, a Sunday, a day on which the contract specifically suspends work, or one of these holidays: January 1, the third Monday of January, the third Monday of February, Memorial Day, July 4, Labor Day, November 11, Thanksgiving Day, the day after Thanksgiving, and Christmas Day. When any of these holidays fall on a Sunday, the following Monday shall be counted a non-working day. When the holiday falls on a Saturday, the preceding Friday shall be counted a non-working day.

An unworkable day is defined as a partial or whole day the Supervising Contractor declares to be unworkable because of weather, conditions caused by the weather, or such other conditions beyond the control of the Contractor that prevents satisfactory and timely performance of the work, and such performance, if not hindered, would have otherwise progressed toward physical completion of the work.

Contract time shall begin on the first working day following the 10th calendar day after the date the Owner executes the contract. The contract provisions may specify another starting date for contract time, in which case, time will begin on the starting date specified.

During the life of the contract, each working day shall be charged to the contract as it occurs. Each week the Supervising Contractor will provide the Contractor a statement that shows the number of working days: (1) charged to the contract the week before; (2) specified for the physical completion of the contract; and (3) remaining for the physical completion of the contract. The statement will also show the nonworking days and any partial or whole day the Supervising Contractor declares as unworkable. Within 10 calendar days after the date of each statement, the Contractor shall file a written protest of any alleged discrepancies in it. To be considered by the Supervising Contractor, the protest shall be in sufficient detail to enable the Supervising Contractor to ascertain the basis and amount of time disputed. By not filing such detailed protest in that period, the Contractor shall be deemed as having accepted the statement as correct. The Supervising Contractor will give the Contractor written notice of the physical completion date for all work the contract requires. That date shall constitute the physical completion date of the contract, but shall not imply the Secretary's acceptance of the work or the contract.

The Supervising Contractor will give the Contractor written notice of the completion date of the contract after all the Contractor's obligations under the contract have been performed by the Contractor. The following events must occur before the Completion Date can be established:

1. The physical work on the project must be complete; and
2. The Contractor must furnish all documentation required by the contract and required by law, to allow the Owner to process final acceptance of the contract.

#### **1-08.6 Suspension of Work**

The Supervising Contractor may order suspension of all or any part of the work if:

1. Unsuitable weather and such other conditions beyond the control of the Contractor that prevent satisfactory and timely performance of the work; or
2. The Contractor does not comply with the contract or the Supervising Contractor's orders.

When ordered by the Supervising Contractor to suspend or resume work, the Contractor shall do so immediately.

If the work is suspended for reason (1) above, the period of work stoppage will be counted as unworkable days. But if the Supervising Contractor believes the Contractor should have completed the suspended work before the suspension, all or part of the suspension period may be counted as working days. The Supervising Contractor will set the number of unworkable days (or parts of days) by deciding how long the suspension delayed the entire project.

If the work is suspended for reason (2) above, the period of work stoppage will be counted as working days. The lost work time, however, shall not relieve the Contractor from any contract responsibility.

If the performance of all or any part of the work is suspended, delayed, or interrupted for an unreasonable period of time by an act of the Owner in the administration of the contract, or by failure to act within the time specified in the contract (or if no time is specified, within a reasonable time), the Supervising Contractor will make an adjustment for any increase in the cost or time for the performance of the contract (excluding profit) necessarily caused by the suspension, delay, or interruption. However, no adjustment will be made for any suspension, delay, or interruption if (1) the performance would have been suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or (2) an equitable adjustment is provided for or excluded under any other provision of the contract.

If the Contractor believes that the performance of the work is suspended, delayed, or interrupted for an unreasonable period of time and such suspension, delay, or interruption is the responsibility of the Owner, the Contractor shall immediately submit a written notice of protest to the Supervising Contractor as provided in Section 1-04.5. No adjustment shall be allowed for any costs incurred more than 10 calendar days before the date the Supervising Contractor receives the Contractor's written notice of protest. If the Contractor contends damages have been suffered as a result of such suspension, delay, or interruption, the protest shall not be allowed unless the protest (stating the amount of damages) is asserted in writing as soon as practicable, but no later than the date of the Contractor's signature on the Final Contract Voucher Certification. The Contractor shall keep full and complete records of the costs and additional time of such suspension, delay, or interruption and shall permit the Supervising Contractor to have access to those records and any other records as may be deemed necessary by the Supervising Contractor to assist in evaluating the protest.

The Supervising Contractor will determine if an equitable adjustment in cost or time is due as provided in this section. The equitable adjustment for increase in costs, if due, shall be subject to the limitations provided in Section 1-09.4, provided that no profit of any kind will be allowed on any increase in cost necessarily caused by the suspension, delay, or interruption.

Request for extensions of time will be evaluated in accordance with Section 1-08.8.

The Supervising Contractor's determination as to whether an adjustment should be made will be final as provided in Section 1-05.1.

No claim by the Contractor under this clause shall be allowed unless the Contractor has followed the procedures provided in this Section and in Sections 1-04.5 and 1-09.11.

#### **1-08.7 Maintenance During Suspension**

Before and during any suspension (as described in Section 1-08.6) the Contractor shall protect the work from damage or deterioration. Suspension shall not relieve the Contractor from anything the contract requires unless this section states otherwise.

At no expense to the Owner, the Contractor shall provide through the construction area a safe, smooth, and unobstructed roadway for public use during suspension (as required in Section 1-07.23 or the special provisions). This may include a temporary road or detour.

If the Supervising Contractor determines that the Contractor failed to pursue the work diligently before the suspension, or failed to comply with the contract or orders, then the Contractor shall maintain the temporary roadway in use during suspension. In this case, the Contractor shall bear the maintenance costs. If the Contractor fails to maintain the temporary roadway, the Owner will do the work and deduct all resulting costs from payments due to the Contractor.

If the Supervising Contractor determines that the Contractor has pursued the work diligently before the suspension, then the Owner will do the routine maintenance work (and bear its cost). This Owner-provided maintenance work will include only routine maintenance of:

1. The traveled way, auxiliary lanes, shoulders, and detour surface.

2. Roadway drainage along and under the traveled roadway or detour, and
3. All barricades, signs, and lights needed for directing traffic through the temporary roadway or detour in the construction area.

The Contractor shall protect and maintain (and bear the costs of doing so) all other work in areas not used by traffic.

After any suspension during which the Owner has done the routine maintenance, the Contractor shall accept the traveled roadway or detour as is when work resumes. The Contractor shall make no claim against the Owner for the condition of the roadway or detour.

After any suspension, the Contractor shall retain all responsibilities the contract assigns for repairing or restoring the roadway, its slopes, and its drainage system to the requirements of the plans.

#### 1-08.8 Extensions of Time

The Contractor shall submit any requests for time extensions to the Supervising Contractor in writing no later than 10 working days after the delay occurs. The request shall be limited to the change in the critical path of the Contractor's schedule attributable to the change or event giving rise to the request. To be considered by the Supervising Contractor, the request shall be in sufficient detail (as determined by the Supervising Contractor) to enable the Supervising Contractor to ascertain the basis and amount of the time requested. The Contractor shall be responsible for showing on the progress schedule that the change or event: (1) had a specific impact on the critical path, and except in cases of concurrent delay, was the sole cause of such impact, and (2) could not have been avoided by resequencing of the work or other reasonable alternatives. If a request, combined with previous extension requests, equals 20 percent or more of the original contract time, the Contractor's letter of request must bear consent of Surety. In evaluating any request, the Supervising Contractor will consider how well the Contractor used the time from contract execution up to the point of the delay and the effect the delay has on any completion times included in the special provisions.

The contract's time for physical completion will be extended for a period equal to the time the Supervising Contractor determines the work was delayed because of:

1. Unsuitable weather, provided that:
  - a. The Supervising Contractor had not already allowed it as an unworkable day under Section 1-08.5, and
  - b. The Contractor had timely filed a written protest asserting that time the Supervising Contractor charged as a working day should have been allowed as an unworkable day.
2. Any action, neglect, or default of the Owner, its officers, or employees, or of any other contractor employed by the Owner;
3. Fire or other casualty for which the Contractor is not responsible;
4. Strikes;
5. Any other conditions for which these Specifications permit time extensions such as:
  - a. In Section 1-04.4 if a change increases the time to do any of the work including unchanged work;
  - b. In Section 1-04.5 if increased time is part of a protest that is found to be a valid protest;
  - c. In Section 1-04.6 if increases exceed 25 percent and these increases caused a delay in completing the contract;
  - d. In Section 1-04.7 if a changed condition is determined to exist which caused a delay in completing the contract;
  - e. In Section 1-05.3 if the Owner does not approve properly prepared and acceptable drawings within 30 calendar days;
  - f. In Section 1-07.13 if the performance of the work is delayed as a result of damage by others;
  - g. In Section 1-07.17 if the removal or the relocation of any utility by forces other than the Contractor caused a delay;
  - h. In Section 1-07.24 if a delay results from all the right of way necessary for the construction not being purchased and the special provisions does not make specific provisions regarding unpurchased right of way;
  - i. In Section 1-08.6 if the performance of the work is suspended, delayed, or interrupted for an unreasonable period of time that proves to be the responsibility of the Owner; or
  - j. In Section 1-09.11 if a dispute or claim also involves a delay in completing the contract and the dispute or claim proves to be valid.
6. Exceptional causes not specifically identified in items 1 through 5, provided the request letter proves the Contractor had no control over the cause of the delay and could have done nothing to avoid or shorten it.

The Supervising Contractor will not allow a time extension for any cause listed above if it resulted from the Contractor's default, collusion, action or inaction, or failure to comply with the contract.

The Owner considers the time specified in the special provisions as sufficient to do all the work. For this reason, the Owner will not grant a time extension for:

- Failure to obtain all materials and workers;
- Changes, protest, increased quantities, or changed conditions (Section 1-04) that do not delay the completion of the contract or prove to be an invalid or inappropriate time extension request;
- Delays caused by nonapproval of drawings or plans as provided in Section 1-05.3;
- Rejection of faulty or inappropriate equipment as provided in Section 1-05.9;
- Correction of thickness deficiency as provided in Section 5-05.5(1)B.

The reasons for and times of extensions shall be determined by the Supervising Contractor, and such determination will be final as provided in Section 1-05.1.

#### **1-08.9 Liquidated Damages**

When the contract work has progressed to the extent that the Owner has full and unrestricted use and benefit of the facilities, both from the operational and safety standpoint, and only minor incidental work, replacement of temporary substitute facilities, or correction or repair remains to physically complete the total contract, the Supervising Contractor may determine the contract work is substantially complete. The Supervising Contractor will notify the Contractor in writing of the substantial completion date. For overruns in contract time occurring after the date so established, the formula for liquidated damages shown above will not apply. For overruns in contract time occurring after the substantial completion date, liquidated damages shall be assessed on the basis of direct engineering and related costs assignable to the project until the actual physical completion date of all the contract work. The Contractor shall complete the remaining work as promptly as possible. Upon request by the Supervising Contractor, the Contractor shall furnish a written schedule for completing the physical work on the contract.

Liquidated damages will not be assessed for any days for which an extension of time is granted. No deduction or payment of liquidated damages will, in any degree, release the Contractor from further obligations and liabilities to complete the entire contract.

#### **1-08.10 Termination of Contract**

##### **1-08.10(1) Termination for Default**

The Owner may terminate the contract upon the occurrence of any one or more of the following events:

1. If the Contractor fails to supply sufficient skilled workers or suitable materials or equipment;
2. If the Contractor refuses or fails to prosecute the work with such diligence as will ensure its physical completion within the original physical completion time and any extensions of time which may have been granted to the Contractor by change order or otherwise;
3. If the Contractor is adjudged bankrupt or insolvent, or makes a general assignment for the benefit of creditors, or if the Contractor or a third party files a petition to take advantage of any debtor's act or to reorganize under the bankruptcy or similar laws concerning the Contractor, or if a trustee or receiver is appointed for the Contractor or for any of the Contractor's property on account of the Contractor's insolvency, and the Contractor or its successor in interest does not provide adequate assurance of future performance in accordance with the contract within 15 calendar days of receipt of a request for assurance from the Owner;
4. If the Contractor disregards laws, ordinances, rules, codes, regulations, orders or similar requirements of any public entity having jurisdiction;
5. If the Contractor disregards the authority of the Owner;
6. If the Contractor performs work which deviates from the contract, and neglects or refuses to correct rejected work; or
7. If the Contractor otherwise violates in any material way any provisions or requirements of the contract.

Once the Owner determines that sufficient cause exists to terminate the contract, written notice shall be given to the Contractor and its Surety indicating that the Contractor is in breach of the contract and that the Contractor is to remedy the breach within 15 calendar days after the notice is sent. In case of an emergency such as potential damage to life or property, the response time to remedy the breach after the notice may be shortened. If the remedy does not take place to the satisfaction of the Owner, the Supervising Contractor may, by serving written notice to the Contractor and Surety either:

1. Transfer the performance of the work from the Contractor to the Surety; or
2. Terminate the contract and at the Owner's option prosecute it to completion by contract or otherwise. Any extra costs or damages to the Owner shall be deducted from any money due or coming due to the Contractor under the contract.

If the Supervising Contractor elects to pursue one remedy, it will not bar the Supervising Contractor from pursuing other remedies on the same or subsequent breaches.

Upon receipt of a notice that the work is being transferred to the Surety, the Surety shall enter upon the premises and take possession of all materials, tools, and appliances for the purpose of completing the work included under the contract and employ by contract or otherwise any person or persons satisfactory to the Supervising Contractor to finish the work and provide the materials without termination of the contract. Such employment shall not relieve the Surety of its obligations under the contract and the bond. If there is a transfer to the Surety, payments on estimates covering work subsequent to the transfer shall be made to the extent permitted under law to the Surety or its agent without any right of the Contractor to make any claim.

If the Supervising Contractor terminates the contract or provides such sufficiency of labor or materials as required to complete the work, the Contractor shall not be entitled to receive any further payments on the contract until all the work contemplated by the contract has been fully performed. The Contractor shall bear any extra expenses incurred by the Owner in completing the work, including all increased costs for completing the work, and all damages sustained, or which may be sustained, by the Owner by reason

of such refusal, neglect, failure, or discontinuance of work by the Contractor. If liquidated damages are provided in the contract, the Contractor shall be liable for such liquidated damages until such reasonable time as may be required for physical completion of the work. After all the work contemplated by the contract has been completed, the Supervising Contractor will calculate the total expenses and damages for the completed work. If the total expenses and damages are less than any unpaid balance due the Contractor, the excess will be paid by the Owner to the Contractor. If the total expenses and damages exceed the unpaid balance, the Contractor and the Surety shall be jointly and severally liable to the Owner and shall pay the difference to the State Treasurer, Department of Transportation on demand.

In exercising the Owner's right to prosecute the physical completion of the work, the Owner shall have the right to exercise its sole discretion as to the manner, method, and reasonableness of the costs of completing the work. In the event that the Owner takes bids for remedial work or physical completion of the project, the Contractor shall not be eligible for the award of such contracts.

In the event the contract is terminated, the termination shall not affect any rights of the Owner against the Contractor. The rights and remedies of the Owner under the Termination Clause are in addition to any other rights and remedies provided by law or under this contract. Any retention or payment of monies to the Contractor by the Owner will not release the Contractor from liability.

#### **1-08.10(2) Termination for Convenience**

The Owner may terminate the contract in whole, or from time to time in part, whenever:

1. The Contractor is prevented from proceeding with the work as a direct result of an Executive Order of the President with respect to the prosecution of war or in the interest of national defense; or an Executive Order of the President or Governor of the State with respect to the preservation of energy resources;
2. The Contractor is prevented from proceeding with the work by reason of a preliminary, special, or permanent restraining order of a court of competent jurisdiction where the issuance of such restraining order is primarily caused by acts or omissions of persons or agencies other than the Contractor; or
3. The Supervising Contractor determines that such termination is in the best interests of the Owner.

#### **1-08.10(3) Payment for Termination for Convenience**

Whenever the contract is terminated in accordance with Section 1-08.10(2), payment will be made for the actual work performed at unit contract prices for completed items of work. An equitable adjustment for partially completed items of work and disposal of materials will be made as provided in Section 1-09.5.

#### **1-08.10(4) Termination for Convenience Claims**

After receipt of Termination for Public Convenience as provided in Section 1-08.10(2), the Contractor shall submit to the Owner a claim for costs associated with the termination in accordance with the procedures outlined in Sections 1-09.11 and 1-09.12. The claim shall be submitted promptly but in no event later than 90 calendar days from the effective date of termination. The Contractor's claim for costs shall be priced in accordance with Sections 1-09.4 and 1-09.5. If the Owner and the Contractor cannot settle the claim, the matter will be resolved as outlined in Section 1-09.13.

If the termination occurs because of the issuance of a restraining order as provided in Section 1-08.10(2), the procedure and pricing described above remain the same except that if the parties cannot reach agreement, the matter will be resolved through mandatory and binding arbitration as described in Sections 1-09.13(3) A and B, regardless of the amount of the claim.

The Contractor agrees to make all records available to the extent deemed necessary by the Supervising Engineer to verify the claim.

#### **1-08.10(5) Responsibility of the Contractor and Surety**

Termination of a contract shall not relieve the Contractor of any responsibilities under the contract for work performed. Nor shall termination of the contract relieve the Surety or Sureties of obligations under the contract bond or retainage bond for work performed.

### **1-09 MEASUREMENT AND PAYMENT**

#### **1-09.1 Measurement of Quantities**

Supervising Contractor will perform all survey for measurement for payment. Contractor shall request survey for measurement from Supervising Contractor three (3) days in advance of the time survey for measurement is desired. Contractor shall be responsible for securing and providing access to areas for measurement to Supervising Contractor.

In measuring all acceptably completed bid items of work, the Supervising Contractor will:

1. Use United States standard measure,
2. Make all measurements as described in this section, unless individual specifications require otherwise,
3. Follow methods generally recognized as conforming to good engineering practice.

4. Conform to the usual practice of the Owner by carrying measurements and computations to the proper significant figure or fraction of units for each item, and
5. Measure horizontally or vertically (unless otherwise specified).

The terms listed below shall be defined as follows in all measurements under this section:

- "Lump Sum" (when used as an item of payment): complete payment for the work described for that item in the contract.
- "Gage" (in measurement of plates): the U.S. Standard Gage.
- "Gage" (in measurement of galvanized sheets used to manufacture corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing): that specified in AASHTO M 36, M 167, M 196, M 197, or M 219.
- "Gage" (in measurement of wire): that specified in AASHTO M 32.
- "Ton": 2,000 pounds of avoirdupois weight.

For each basis of measurement listed below, the Supervising Contractor will use the method of measurement described. For bid items or materials measured on the basis of:

**Square Yard or Square Foot** — measured on the neat dimensions shown in the plans or as altered by the Supervising Contractor. If an individual fixture has an area of 9 square feet or less, no deductions in area will be made.

**Linear Foot** (pipe culverts, guard rail, underdrains, etc.) — measured parallel to the structure's base or foundation, unless the plans require otherwise.

**Weight** — weighed as required in Section 1-09.2.

**Volume** (of excavation and embankment) — measured by the average-end-area method or by the finite element analysis method utilizing digital terrain modeling techniques. All or some computations may be based on ground elevations and other data derived photogrammetrically. The Supervising Contractor may correct for curvature.

**Volume** (in the hauling vehicle) — measured at the point of delivery. Hauling vehicles may be of any size or type the Supervising Contractor approves provided that the body is of such shape that the actual contents may be readily and accurately determined. If the Supervising Contractor requires, the Contractor shall level loads at the delivery point to facilitate measurement.

For each item listed below, the Supervising Contractor will use the method of measurement described.

**Structures** — measured on the neat lines shown in the plans or as altered by the Supervising Contractor. When a complete structure or structural unit is specified as the unit of measurement, the unit shall include all fittings and accessories.

**Timber** — measured by the thousand board feet (MBM) actually used in the structure. Measurements will be based on nominal widths and thicknesses and the extreme length of each piece.

**Standard Manufactured Items** (fence, wire, plates, rolled shapes, pipe conduit, etc., when specified) — measured by the manufacturer's identification of gage, unit weight, section dimension, etc. The Supervising Contractor will accept manufacturing tolerances set

by each industry unless cited specifications require more stringent tolerances.

**Cement** — measured by the pound, ton, or sack. A sack shall be 94 pounds.

**Asphalt** — measured by the gallon or ton. If measured by gallon, measurement will be made at 60 F (or will be corrected to the volume at 60 F in keeping with ASTM D 1250). If shipped by rail, truck, or transport, measurement will be by net certified scale masses or certified volumes (corrected for material lost enroute or not actually incorporated into the work). The Supervising Contractor will use the following volume-weight conversion table to compute asphalt measurements:

**Conversion Factors  
Average Weights and Volume of Asphalt**

Grade	Gallons per Ton @ 60 F	Pounds per Gallon @ 60 F
<i>Liquid Asphalts</i>		
70	253	7.90
250	249	8.03
800	245	8.16
3000	241	8.30
<i>Paving Asphalts</i>		
AR 2000W	237	8.44
AR 4000W	235	8.51
<i>Emulsified Asphalts</i>		
All Grades	240	8.33

No measurement will be made for:

1. Work performed or materials placed outside lines shown in the plans or set by the Supervising Contractor;
2. Materials wasted, used, or disposed of in a manner contrary to the contract;
3. Rejected materials (including those rejected after placement if the rejection resulted from the Contractor's failure to comply with the contract);
4. Hauling and disposing of rejected materials;
5. Material remaining on hand after the work is completed, except as provided in Sections 1-09.5 and 1-09.10; or
6. Any other work or material contrary to any contract provision.

## **1-09.2 Weighing Equipment**

### **1-09.2(1) General Requirements for Weighing Equipment**

Any highway or bridge construction materials to be proportioned or measured and paid for by weight, shall be weighed on scales. These materials include natural, manufactured, or processed materials obtained from natural deposits, stockpiles, or bunkers. The Contractor shall provide, set up, and maintain the scales or use permanently installed, certified, commercial scales.

Each truck to be weighed shall bear a unique identification number. This number shall be legible and in plain view of the scale operator.

Scales shall:

1. Be accurate to within one-half of 1 percent throughout the range of use;
2. Not include spring balances;
3. Include beams, dials, or other reliable readout equipment;
4. Be arranged so that operators and inspectors can safely and easily see the dials, beams, rods, and operating scale mechanisms;
5. Be built to prevent scale parts from binding, vibrating, or being displaced and to protect all working parts from falling material, wind, and weather; and
6. Be carefully maintained, with (a) bunkers and platforms kept clear of accumulated materials that could cause errors and (b) knife edges given extra care and protection.

At each batching and platform scale location, the Contractor shall have available not less than 10 standard 50-pound weights for scale calibration and testing. If the Supervising Contractor has approved other calibration and testing equipment, the Contractor may substitute it for these weights.

### **1-09.2(2) Specific Requirements for Batching Scales**

All materials proportioned by weight shall be weighed on an accurate, approved scale by qualified operators employed by the Contractor. Scale locations require the Supervising Contractor's approval.

Each scale shall be designed to support a weighing hopper. The arrangement shall make it convenient for the operator to remove material from the hopper while watching readout devices. Any hopper mounted on a platform scale shall have its center of gravity directly over the platform center line.

Marked intervals on the readout device shall be spaced evenly throughout and shall be based on the scale's nominal rated capacity. These intervals shall be at least 1 pound, but shall not exceed one-tenth of 1 percent of nominal rated capacity.

An agent of the scale manufacturer shall test and service any batch scale before its use at each new site and then at 6-month intervals. The Contractor shall provide the Supervising Contractor a copy of the final results after each test. Whenever the Supervising Contractor requests, the Contractor's operator(s) shall test the scale while the inspector observes.

Portland or asphalt cement shall be weighed on a scale not used for other materials.

### **1-09.2(3) Specific Requirements for Platform Scales**

Each platform scale shall be able to weigh the entire hauling vehicle or combination of connected vehicles at one time. No part of the vehicle or vehicle combination will be permitted off the platform as it is weighed.

The Supervising Contractor will provide, at no cost to the Contractor, an operator to weigh and record the weight of all materials. The Contractor shall provide the platform scales and any tickets required for self-printing scales.

Unless the Supervising Contractor permits otherwise, each vehicle operator shall obtain a weigh or load ticket from the scale operator. The vehicle operator shall deliver the ticket in legible condition to the Material Receiver at the material delivery point.

Each weigh or load ticket shall contain gross, net, and tare weight. It shall also identify the weighed material. A tare weight shall be taken of each hauling vehicle at least twice a day.

If commercial scales are used, the Contractor shall:

1. Provide the scale operator with approved load tickets;
2. Provide duplicate, legible copies to the Material Receiver at the delivery point; and
3. Guarantee permission for an agent of the Supervising Contractor to observe the weighing and to check and compile the daily scale weight record.

Each commercial weigher shall test the scales at least daily. Test methods and procedures for recording test results and tare weight shall be approved in advance by the Supervising Contractor. Several times each day, the operator shall make certain the scale balances and returns to zero when the load is removed.

Any Contractor-supplied scale shall include a scale house with a floor space of at least 6 by 10 feet. The scale house shall be wind and weather tight, shall have windows for light and ventilation, shall include a door, and shall be lockable. It shall include a table, a chair, electrical power, and a space heater. The Contractor shall provide a rest room near the scale house.

Any platform scale shall be installed and maintained with the platform level and with rigid bulkheads at either end to prevent binding or shifting. The readout device shall be marked at intervals of no more than 40 pounds. Test records shall show results to the nearest 20 pounds. During weighing operations, weights shall be read and recorded to the nearest 100 pounds.

Before use at a new site and then at 6-month intervals, the scale shall be: (a) approved under rules of the Washington State Department of Agriculture's Weights and Measures Section, or (b) serviced and tested with at least 10,000 pounds by an agent of its manufacturer. In any case, the Contractor shall provide the Supervising Contractor with a copy of the final test results.

#### **1-09.2(4) Specific Requirements for Belt Conveyor Scales**

The Supervising Contractor may approve conveyor-belt weighing of untreated materials if the method and device meet all general requirements for weighing equipment.

All belt-conveyor scales shall comply with the requirements for Belt-Conveyor Scales in the National Bureau of Standards Handbook No. 44, except where these Specifications modify those requirements.

A static load test shall be made: (a) each day after the belt-conveyor has run continuously for about 30 minutes, and (b) immediately after air temperature changes significantly. If the static load test reveals a need for adjustment, the Contractor shall make a chain test.

The Contractor shall keep available for the Supervising Contractor's review: the computation of the test chain calibration, the calibration procedures and results, and related records. The test chain shall be clearly marked with its calibration, carried in a suitable container, and immediately available for testing.

To test the accuracy of a belt-conveyor scale, the Contractor may weigh five or more payloads from sequential hauling units and compare these weights with weights of the same payloads taken on platform scales meeting the requirements of these Specifications. The Supervising Contractor will accept an average comparative accuracy of 0.5 percent. Some inaccuracies may occur with this method. This can happen because recording odometers on belt-conveyor scales are normally graduated in 200-pound increments and because the recording is cumulative. Thus, variations smaller than 200 pounds may carry over from payload to payload. To reduce this chance of error, conveyor weights will be based on tonnage values taken from the sealed odometer at the beginning and end of each check period. If the test results fluctuate, the Supervising Contractor may require more than five check loads.

The Contractor shall provide self-printing, serially numbered tickets that show time and date of loading, approximate load-out weight, and the hauling vehicle's equipment number. These tickets must be approved by the Supervising Contractor. The truck driver shall imprint each ticket at a recording device at the loading point and shall deliver the ticket in legible condition to the Material Receiver at the material delivery point.

The recording tape, odometer, totalizer, calibration adjustment, and clock-time imprinter shall be kept locked. The Supervising Contractor shall retain all keys.

#### **1-09.2(5) Measurement**

If testing shows the scale has been underweighing, it shall be adjusted immediately. The Contractor shall not be compensated for any loss from underweighing.



If the scale has been overweighting, its operation will cease immediately until adjusted. The Owner will calculate the combined weight of all materials weighed after the last test showing accurate results. This combined weight will then be reduced by the percentage of scale error that exceeds one-half of 1 percent.

If the specifications and plans require weight measurement for minor construction items, the Contractor may request permission to convert volume to weight. If the Supervising Contractor approves, the factor of 1.25 tons per cubic yard of volume measure may be used to make this conversion.

#### **1-09.2(6) Payment**

The Owner will pay for no materials received by weight unless they have been weighed as required in this section or as required by another method the Supervising Contractor has approved in writing.

Payment will not be made for any material over the maximum gross legal weight for the hauling vehicle as provided in Section 1-07.7.

Unit contract prices for the various pay items of the project cover all costs related to weighing and proportioning materials for payment. These costs include those for furnishing, installing, certifying, and maintaining scales, those for furnishing check weights and scale house, and those for any other related item specified in this section.

#### **1-09.3 Scope of Payment**

The payment provided for in the contract shall be full payment to the Contractor for:

1. Furnishing all materials and performing all work under the contract (including changes in the work, materials, or plans) in a complete and acceptable manner;
2. All risk, loss, damage, or expense of whatever character arising out of the nature or prosecution of the work; and
3. All expense incurred resulting from a suspension or discontinuance of the work as specified under the contract.

The payment of any estimate or retained percentage shall not relieve the Contractor of the obligation to make good any defective work or materials.

Unless the plans and special provisions provide otherwise, the unit contract prices for the various bids items shall be full payment for all labor, materials, supplies, equipment, tools, and all other things required to completely incorporate the item into the work as though the item were to read "In Place."

If the "Payment" clause in the specifications, for an item included in the proposal, covers and considers all work and material essential to that item, then the work or materials will not be measured or paid for under any other item which may appear elsewhere in the proposal or specifications.

Certain payment items appearing in these Specifications may be modified in the plans and proposal to include:

1. The words "For Structure," "For Concrete Barrier," "For Bridge," etc. with the intent of clarifying specific use of the item; or
2. The words "Site (Site Designation)," with the intent of clarifying where a specific item of work is to be performed.

Modification of payment items in this manner shall in no way change the intent of the specifications relating to these items.

#### **1-09.4 Equitable Adjustment**

The equitable adjustment provided for elsewhere in the contract shall be determined in one or more of the following ways:

1. If the parties are able to agree, the price will be determined by using:
  - a. Unit prices, or
  - b. Other agreed upon prices;
2. If the parties can not agree, the price will be determined by the Supervising Contractor using:
  - a. Unit prices, or
  - b. Other means to establish costs.

The following limitations shall apply in determining the amount of the equitable adjustment:

1. The equipment rates shall be actual cost but shall not exceed the rates set forth in the AGC/WSDOT Equipment Rental Agreement in effect at the time the work is performed as referred to in Section 1-09.6, and
2. To the extent any delay or failure of performance was concurrently caused by the Owner and the Contractor, the Contractor shall be entitled to a time extension for the portion of the delay or failure of performance concurrently caused, provided it make such a request pursuant to Section 1-08.8; however, the Contractor shall not be entitled to any adjustment in contract price.
3. No claim for anticipated profits on deleted, terminated, or uncompleted work will be allowed.

4. No claim for consequential damages of any kind will be allowed.

#### **1-09.5 Deleted or Terminated Work**

The Supervising Contractor may delete work by change order as provided in Section 1-04.4 or may terminate the contract in whole or part as provided in Section 1-08.10(2). When the contract is terminated in part, the partial termination shall be treated as a deletion change order for payment purposes under this section.

Payment for completed items will be at unit contract prices.

When any item is deleted in whole or in part by change order or when the contract is terminated in whole or in part, payment for deleted or terminated work will be made as follows:

1. Payment will be made for the actual number of units of work completed at the unit contract prices unless the Supervising Contractor determines the unit prices are inappropriate for the work actually performed. When that determination is made by the Supervising Contractor, payment for work performed will be as mutually agreed. If the parties cannot agree the Supervising Contractor will determine the amount of the equitable adjustment in accordance with Section 1-09.4;
2. Payment for partially completed lump sum items will be as mutually agreed. If the parties cannot agree, the Supervising Contractor will determine the amount of the equitable adjustment in accordance with Section 1-09.4;
3. To the extent not paid for by the contract prices for the completed units of work, the Owner will pay as part of the equitable adjustment those direct costs necessarily and actually incurred by the Contractor in anticipation of performing the work that has been deleted or terminated;
4. The total payment for any one item in the case of a deletion or partial termination shall not exceed the bid price as modified by approved change orders less the estimated cost (including overhead and profit) to complete the work and less any amount paid to the Contractor for the item;
5. The total payment where the contract is terminated in its entirety shall not exceed the total contract price as modified by approved change orders less those amounts paid to the Contractor before the effective date of the termination; and
6. No claim for damages of any kind or for loss of anticipated profits on deleted or terminated work will be allowed because of the termination or change order.

Contract time shall be adjusted as the parties agree. If the parties cannot agree, the Supervising Contractor will determine the equitable adjustment for contract time.

Acceptable materials ordered by the Contractor prior to the date the work was terminated as provided in Section 1-08.10(2) or deleted as provided in Section 1-04.4 by the Supervising Contractor, will either be purchased from the Contractor by the Owner at the actual cost and shall become the property of the Owner, or the Owner will reimburse the Contractor for the actual costs connected with returning these materials to the suppliers.

#### **1-09.6 Force Account**

If the contract calls for work or materials to be paid for by force account, payment amounts will be determined as shown below.

1. For Labor. The Owner will reimburse the Contractor for labor and for supervision by foremen dedicated solely to the particular force account item of work (but not for supervision by general superintendents or general foremen). The Supervising Contractor will compute the labor payment on the basis of these four factors:
  - a. Weighted Wage Rate. The Weighted Wage Rate combines:
    - (1) the current basic wage and fringe benefits the Contractor is required and has agreed to pay,
    - (2) Federal Insurance Compensation (FICA),
    - (3) Federal Unemployment Tax Act (FUTA), and
    - (4) State Unemployment Compensation Act (SUCA)A Weighted Wage Rate shall be computed for each classification of labor used. This rate shall reflect the Contractor's actual cost. It shall neither exceed what is normally paid to comparable labor nor fall below the minimum required by Section 1-07.9. If the Supervising Contractor authorizes overtime, the Weighted Wage Rate shall be determined on the same basis.
  - b. Travel Allowance and Subsistence. This includes the actual costs of allowances for travel or subsistence paid to employees in the course of their work on the item. This reimbursement will be made only if such allowances are required by a regional labor agreement or are normally paid by the Contractor to comparable labor for performing other work.
  - c. Industrial Insurance and Medical Aid Premiums. The Owner will reimburse Contractor-paid premiums for Marine Industrial Insurance, for State of Washington Industrial Insurance, and Medical Aid Premiums which become an obligation of the Contractor and are chargeable to the force account work. The Owner will not pay the Contractor
  - d. for Medical Aid premiums that are paid by the employees.
  - e. Overhead and Profit. The Owner will pay the Contractor 20 percent of the sum of the costs listed in a, b, and c above to cover project overhead, general company overhead, profit, and any other costs incurred.

2. For Materials. The Owner will reimburse actual invoice cost for Contractor-supplied materials. This cost includes actual freight and express charges and taxes as described in Section 1-07.2 provided that these costs have not been paid in some other manner under the contract. A deduction will be made for any offered or available discounts or rebates if the Owner has provided the Contractor with the means to comply with the provisions allowing the discount. The Owner will then add 15 percent of the balance to cover project overhead, general company overhead, profit, and any other cost of supplying materials.

To support charges for materials, the Contractor shall provide the Supervising Contractor with valid copies of vendor invoices, including freight and express bills. If invoices are not available for materials from the Contractor stocks, the Contractor shall certify actual costs by affidavit.

If claims for materials costs are too high, inappropriate, or unsupported by satisfactory evidence, the Supervising Contractor may determine the cost for all or part of the materials. When determined in this manner, the cost will be the lowest current wholesale price from a source that can supply the required quantity (including delivery costs).

The Owner reserves the right to provide materials. In this case, the Contractor will receive no payment for any costs, overhead, or profit.

3. For Equipment. The approval of the Supervising Contractor shall be required for the selection of machine-power tools or equipment prior to their use on force account.

The payment for any machine-power tools or equipment shall be made according to the current AGC/WSDOT Equipment Rental Agreement which is in effect at the time the force account is authorized. The rates as set forth in the Rental Rate Blue Book (as modified by the current AGC/WSDOT Equipment Rental Agreement) are the maximum rates allowable for equipment of modern design and in good working condition. These rates shall be full compensation for all fuel, oil, lubrication, repairs, maintenance, and all other costs incidental to furnishing and operating the equipment except labor for operation.

The Owner will add 15 percent to equipment costs to cover project overhead, general company overhead (excluding equipment overhead included in the Rental Rate Blue Book), and profit.

Current copies of the Rental Rate Blue Book and the AGC/WSDOT Equipment Rental Agreement will be maintained at each Region office of the Department of Transportation and at each of the offices of the Associated General Contractors of America (in Tacoma) where they are available for inspection.

4. Force Account Mobilization. Force account mobilization is defined as the preparatory work performed by the Contractor including transportation of tools, equipment, and personal travel time (when included in a bargaining agreement). The Owner may pay for mobilization of equipment and labor if the force account item is not an item included in the original contract proposal or such other contract items as may be included in the special provisions as being eligible for reimbursement for mobilization. Off-site work in preparation for the travel to the project, costing \$300 or less will not be paid. The Owner will not pay for mobilization for off-site preparatory work for force account items under any circumstances unless the Contractor specifically makes a request in writing in advance of any such mobilization work. The written request shall include an estimate for mobilization costs involving off-site preparatory work and the basis for reimbursement. The approval of the Supervising Contractor will be required prior to commencing the mobilization for all force account. To the agreed final amount of mobilization for force account shall be added an amount equal to 15 percent of that sum for all other costs, including project overhead, general company overhead, and profit.
5. Subcontractors. The subcontractors will be allowed a 5 percent markup of the total cost computed from 1, 2, 3, and 4 for insurance, B&O tax, and bonding.
6. Contractor Markup on Subcontractors. When work is performed on a force account basis by approved subcontractors, the Contractor will be allowed an additional markup equal to 5 percent of the total cost computed for 1, 2, 3, 4, and 5 for all administrative costs.
7. Insurance, B&O Tax, and Bonding. The Contractor will be allowed an additional markup equal to 5 percent of the total cost computed for 1, 2, 3, 4, 5, and 6 for insurance, B&O tax, and bonding.

The payments provided above shall be full payment for all work done on a force account basis. The payment shall cover all expenses of every nature, kind, and description, including all overhead expenses, profit, occupational tax and any other Federal or State revenue acts, premiums on public liability and property damage insurance policies, and for the use of small tools and equipment for which no rental is allowed.

No claim for force account shall be allowed except upon written order by the Supervising Contractor prior to the performance of the work. No work shall be construed as force account work which can be measured under the specifications and paid for at the unit prices named in the contract.

The amount and costs of any work to be paid by force account shall be computed by the Supervising Contractor, and the amount certified by the Supervising Contractor shall be final as provided in Section 1-05.1.

The Contractor's wage, payroll, and cost records pertaining to work paid for on a force account basis shall be open to inspection or audit as provided in Section 1-09.12.

#### **1-09.7 Mobilization**

Mobilization consists of pre-construction expenses and the costs of preparatory work and operations performed by the Contractor which occur before 10 percent of the total original contract amount is earned from other contract items. Items which are not to be included in the item of Mobilization include but are not limited to:

1. Any portion of the work covered by the specific contract item or incidental work which is to be included in a contract item or items.
2. Profit, interest on borrowed money, overhead, or management costs.

Based on the lump sum contract price for "Mobilization," partial payments will be made as follows:

1. When 5 percent of the total original contract amount is earned from other contract items, excluding amounts paid for materials on hand, 50 percent of the amount bid for mobilization, or 5 percent of the total original contract amount, whichever is the least, will be paid.
2. When 10 percent of the total original contract amount is earned from other contract items, excluding amounts paid for materials on hand, 100 percent of the amount bid for mobilization, or 10 percent of the total original contract amount, whichever is the least, will be paid.
3. When the physical completion date has been established for the project, payment of any amount bid for mobilization in excess of 10 percent of the total original contract amount will be paid.

Nothing herein shall be construed to limit or preclude partial payments otherwise provided by the contract.

#### **1-09.8 Payment for Material on Hand**

The Owner may reimburse the Contractor for materials purchased before their use in the work if they:

1. Meet the requirements of the plans and specifications;
2. Are delivered to or stockpiled near the project or other Supervising Contractor-approved storage sites; and
3. Consist of: sand, gravel, surfacing materials, aggregates, reinforcing steel, bronze plates, structural steel, machinery, piling, timber and lumber (not including forms or falsework), large signs unique to the project, prestressed concrete beams or girders, or other materials the Supervising Contractor may approve.

The Owner may reimburse the Contractor for traffic signal controllers as follows:

1. Fifty percent when the traffic signal controller and all components are received and assembled into a complete unit at the Olympia Service Center Materials Laboratory.
2. One hundred percent when the traffic signal controller is approved for shipment to the project by the Olympia Service Center Materials Laboratory.

The Contractor shall provide sufficient written evidence of production costs to enable the Supervising Contractor to compute the cost of Contractor-produced materials (such as sand, gravel, surfacing material, or aggregates). For other materials, the Contractor shall provide invoices from material suppliers. Each invoice shall be detailed sufficiently to enable the Supervising Contractor to determine the actual costs. Payment for materials on hand shall not exceed the total contract cost for the contract item.

If payment is based upon an unpaid invoice, the Contractor shall provide the Supervising Contractor with a paid invoice within 60 calendar days after the Owner's initial payment for materials on hand. If the paid invoice is not furnished in this time, any payment the Owner had made will be deducted from the next progress estimate and withheld until the paid invoice is supplied.

The Owner will not pay for material on hand when the invoice cost is less than \$2,000. As materials are used in the work, credits equaling the partial payments for them will be taken on future estimates. Partial payment for materials on hand shall not constitute acceptance. Any material will be rejected if found to be faulty even if partial payment for it has been made.

#### **1-09.9 Payments**

The basis of payment will be the actual quantities of work performed according to the contract and as specified for payment.

Payments will be made for work and labor performed and materials furnished under the contract according to the price in the proposal unless otherwise provided.

Partial payments will be made once each month, based upon partial estimates prepared by the Supervising Contractor.

Failure to perform any of the obligations under the contract by the Contractor may be decreed by the Owner to be adequate reason for withholding any payments until compliance is achieved.

After Contractor has completed all such corrections to the satisfaction of Supervising Contractor and delivered in accordance with the Contract all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance required by the Supplementary Conditions, certificates of inspection, marked-up record documents, and other documents, Contractor may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied (except as previously delivered) by:

- i. all documentation called for in the Contract, including but not limited to the evidence of insurance required by the Supplementary Conditions;
- ii. consent of the surety, if any, to final payment; and
- iii. complete and legally effective releases or waivers (satisfactory to Owner) of all liens arising out of or filed in connection with the work.

In lieu of such releases or waivers of liens and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that:

- i. the releases and receipts include all labor, services, material and equipment for which a lien could be filed, and
- ii. all payrolls, material and equipment bills and other indebtedness connected with the work for which Owner or Owner's property might in any way be responsible have been paid or otherwise satisfied.

If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any lien.

Payment to the Contractor of partial estimates, final estimates, and retained percentages shall be subject to controlling laws.

#### **1-09.10 Payment for Surplus Processed Materials**

After the Contract is completed, the Contractor will be reimbursed actual production costs for surplus processed material produced by the Contractor from Owner-provided sources if its value is \$3,000 or more (determined by actual production costs).

The quantity of surplus material eligible for reimbursement of production costs shall be the quantity produced (but an amount not greater than 110 percent of plan quantity or as specified by the Supervising Contractor), less the actual quantity used. The Owner will determine the actual amount of surplus material for reimbursement.

The Contractor shall not dispose of any surplus material without permission of the Supervising Contractor. Surplus material shall remain the property of the Owner without reimbursement to the Contractor if it is not eligible for reimbursement.

#### **1-09.11 Disputes and Claims**

##### **1-09.11(1) Disputes**

When disputes occur during a contract, the Contractor shall pursue resolution through the Supervising Contractor. The Contractor shall follow the procedures outlined in Section 1-04.5. If the negotiation using the procedures outlined in Section 1-04.5 fails to provide satisfactory resolution, the Contractor shall pursue the more formalized method outlined in Section 1-09.11(2) for submitting a claim.

##### **1-09.11(2) Claims**

If the Contractor claims that additional payment is due and the Contractor has pursued and exhausted all the means provided in Section 1-09.11(1) to resolve a dispute, the Contractor may file a claim as provided in this section. The Contractor agrees to waive any claim for additional payment if the written notifications provided in Section 1-04.5 are not given, or if the Supervising Contractor is not afforded reasonable access by the Contractor to complete records of actual cost and additional time incurred as required by Section 1-04.5, or if a claim is not filed as provided in this section. The fact that the Contractor has provided a proper notification, provided a properly filed claim, or provided the Supervising Contractor access to records of actual cost, shall not in any way be construed as proving or substantiating the validity of the claim. If the claim, after consideration by the Supervising Contractor, is found to have

merit, the Supervising Contractor will make an equitable adjustment either in the amount of costs to be paid or in the time required for the work, or both. If the Supervising Contractor finds the claim to be without merit, no adjustment will be made.

All claims filed by the Contractor shall be in writing and in sufficient detail to enable the Supervising Contractor to ascertain the basis and amount of the claim. All claims shall be submitted to the Supervising Contractor as provided in Section 1-05.15. As a minimum, the following information must accompany each claim submitted:

1. A detailed factual statement of the claim for additional compensation and time, if any, providing all necessary dates, locations, and items of work affected by the claim.
2. The date on which facts arose which gave rise to the claim.
3. The name of each Owner individual, official, or employee involved in or knowledgeable about the claim.
4. The specific provisions of the contract which support the claim and a statement of the reasons why such provisions support the claim.
5. If the claim relates to a decision of the Supervising Contractor which the contract leaves to the Supervising Contractor's discretion or as to which the contract provides that the Supervising Contractor's decision is final, the Contractor shall set out in detail all facts supporting its position relating to the decision of the Supervising Contractor.
6. The identification of any documents and the substance of any oral communications that support the claim.
7. Copies of any identified documents, other than Owner documents and documents previously furnished to the Owner by the Contractor, that support the claim (manuals which are standard to the industry, used by the Contractor, may be included by reference).
8. If an extension of time is sought:
  - a. The specific days and dates for which it is sought,
  - b. The specific reasons the Contractor believes a time extension should be granted,
  - c. The specific provisions of Section 1-08.8 under which it is sought, and
  - d. The Contractor's analysis of its progress schedule to demonstrate the reason for a time extension.
9. If additional compensation is sought, the exact amount sought and a breakdown of that amount into the following categories:
  - a. Labor;
  - b. Materials;
  - c. Direct equipment. The actual cost for each piece of equipment for which a claim is made or in the absence of actual cost, the rates established by the AGC/WSDOT Equipment Rental Agreement which was in effect when the work was performed. In no case shall the amounts claimed for each piece of equipment exceed the rates established by that Equipment Rental Agreement even if the actual cost for such equipment is higher. The Owner may audit the Contractor's cost records as provided in Section 1-09.12 to determine actual equipment cost. The following information shall be provided for each piece of equipment:
    - (1) Detailed description (e.g., Motor Grader Diesel Powered Caterpillar 12 "G," Tractor Crawler ROPS & Dozer Included Diesel, etc.);
    - (2) The hours of use or standby; and
    - (3) The specific day and dates of use or standby;
  - d. Job overhead;
  - e. Overhead (general and administrative);
  - f. Subcontractor's claims (in the same level of detail as specified herein is required for any subcontractor's claims); and
  - g. Other categories as specified by the Contractor or the Owner.
10. A notarized statement shall be submitted to the Supervising Contractor containing the following language:

Under the penalty of law for perjury or falsification, the undersigned,

\_\_\_\_\_  
(name) (title)

of \_\_\_\_\_  
(company)

hereby certifies that the claim for extra compensation and time, if any, made herein for work on this contract is a true statement of the actual costs incurred and time sought, and is fully documented and supported under the contract between the parties.

Dated \_\_\_\_\_/s/ \_\_\_\_\_

Subscribed and sworn before me this \_\_\_\_\_ day of \_\_\_\_\_

\_\_\_\_\_  
Notary Public

My Commission Expires: \_\_\_\_\_

It will be the responsibility of the Contractor to keep full and complete records of the costs and additional time incurred for any alleged claim. The Contractor shall permit the Supervising Contractor to have access to those records and any other records as may be required by the Supervising Contractor to determine the facts or contentions involved in the claim. The Contractor shall retain those records for a period of not less than three years after final acceptance.

The Contractor shall pursue administrative resolution of any claim with the Supervising Contractor or the designee of the Supervising Contractor.

Provided that the Contractor is in full compliance with all the provisions of this section and after the formal claim document has been submitted, the Owner will respond, in writing, to the Contractor as follows:

1. Within 45 calendar days from the date the claim is received by the Owner if the claim amount is less than \$100,000;
2. Within 90 calendar days from the date the claim is received by the Owner if the claim amount is equal to or greater than \$100,000; or
3. If the above restraints are unreasonable due to the complexity of the claim under consideration, the Contractor will be notified within 15 calendar days from the date the claim is received by the Owner as to the amount of time which will be necessary for the Owner to prepare its response.

Full compliance by the Contractor with the provisions of this section is a contractual condition precedent to the Contractor's right to seek judicial relief.

#### **1-09.11(3) Time Limitation and Jurisdiction**

For the convenience of the parties to the contract it is mutually agreed by the parties that any claims or causes of action which the Contractor has against the Owner arising from the contract shall be brought within 180 calendar days from the date of final acceptance (Section 1-05.12) of the contract by the State of Washington. The parties understand and agree that the Contractor's failure to bring suit within the time period provided, shall be a complete bar to any such claims or causes of action. It is further mutually agreed by the parties that when any claims or causes of action which the Contractor asserts against the Owner arising from the contract are filed with the State or initiated in court, the Contractor shall permit the State to have timely access to any records deemed necessary by the State to assist in evaluating the claims or action.

#### **1-09.12 Audits**

##### **1-09.12(1) General**

The Contractor's wage, payroll, and cost records on this contract shall be open to inspection or audit by representatives of the Owner during the life of the contract and for a period of not less than three years after the date of final acceptance of the contract. The Contractor shall retain these records for that period. The Contractor shall also guarantee that the wage, payroll, and cost records of all subcontractors and all lower tier subcontractors shall be retained and open to similar inspection or audit for the same period of time. The audit may be performed by employees of the Owner or by an auditor under contract with the Owner. The Contractor, subcontractors, or lower tier subcontractors shall provide adequate facilities, acceptable to the Supervising Contractor, for the audit during normal business hours. The Contractor, subcontractors, or lower tier subcontractors shall make a good faith effort to cooperate with the auditors. If an audit is to be commenced more than 60 calendar days after the final acceptance date of the contract, the Contractor will be given 20 calendar days notice of the time when the audit is to begin. If any litigation, claim, or audit arising out of, in connection with, or related to this contract is initiated, the wage, payroll, and cost records shall be retained until such litigation, claim, or audit involving the records is completed.

##### **1-09.12(2) Claims**

All claims filed against the Owner shall be subject to audit at any time following the filing of the claim. Failure of the Contractor, subcontractors, or lower tier subcontractors to maintain and retain sufficient records to allow the auditors to verify all or a portion of the claim or to permit the auditor access to the books and records of the Contractor, subcontractors, or lower tier subcontractors shall constitute a waiver of a claim and shall bar any recovery thereunder.

##### **1-09.12(3) Required Documents for Audits**

As a minimum, the auditors shall have available to them the following documents:

1. Daily time sheets and supervisor's daily reports.
2. Collective Bargaining Agreements.
3. Insurance, welfare, and benefits records.
4. Payroll registers.
5. Earnings records.
6. Payroll tax forms.

7. Material invoices and requisitions.
8. Material cost distribution worksheet.
9. Equipment records (list of company equipment, rates, etc.).
10. Vendors', rental agencies', subcontractors', and lower tier subcontractors' invoices.
11. Contracts between the Contractor and each of its subcontractors, and all lower-tier subcontractor contracts and supplier contracts.
12. Subcontractors' and lower tier subcontractors' payment certificates.
13. Canceled checks (payroll and vendors).
14. Job cost reports, including monthly totals.
15. Job payroll ledger.
16. General ledger.
17. Cash disbursements journal.
18. Financial statements for all years reflecting the operations on this contract. In addition, the contracting Agency may require, if it deems appropriate, additional financial statements for 3 years preceding execution of the contract and 3 years following final acceptance of the contract.
19. Depreciation records on all company equipment whether these records are maintained by the company involved, its accountant, or others.
20. If a source other than depreciation records is used to develop costs for the Contractor's internal purposes in establishing the actual cost of owning and operating equipment, all such other source documents.
21. All documents which relate to each and every claim together with all documents which support the amount of damages as to each claim.
22. Worksheets or software used to prepare the claim establishing the cost components for items of the claim including but not limited to labor, benefits and insurance, materials, equipment, subcontractors, all documents which establish the time periods, individuals involved, the hours for the individuals, and the rates for the individuals.
23. Worksheets, software, and all other documents used by the Contractor to prepare its bid.

An audit may be performed by employees of the Owner or a representative of the Owner. The Contractor and its subcontractors shall provide adequate facilities acceptable to the Owner for the audit during normal business hours. The Contractor and all subcontractors shall cooperate with the Owner's auditors.

#### **1-09.13 Claims Resolution**

##### **1-09.13(1) General**

Dispute resolution shall be in accordance with Article 45 of Contract.

#### **1-10 TEMPORARY TRAFFIC CONTROL**

##### **1-10.1 General**

The Contractor shall provide flaggers, signs, and other traffic control devices not otherwise specified as being furnished by the Owner. The Contractor shall erect and maintain all construction signs, warning signs, detour signs, and other traffic control devices necessary to warn and protect the public at all times from injury or damage as a result of the Contractor's operations which may occur on highways, roads, or streets. No work shall be done on or adjacent to the roadway until all necessary signs and traffic control devices are in place.

These flaggers, signs, and other traffic control devices shall be used for the safety of the public, the Contractor's employees, and Owner's personnel and to facilitate the movement of the traveling public. They may be used for the separation or merging of public and construction traffic when in accordance with a specific approved traffic control plan.

Upon failure of the Contractor to immediately provide flaggers; erect, maintain, and remove signs; or provide, erect, maintain, and remove other traffic control devices when ordered to do so by the Supervising Contractor, the Owner may, without further notice to the Contractor or the Surety, perform any of the above and deduct all of the costs from the Contractor's payments.

The Contractor shall be responsible for providing adequate flaggers, signs, and other traffic control devices for the protection of the work and the public at all times regardless of whether or not the flaggers, signs, and other traffic control devices are ordered by the Supervising Contractor, furnished by the Owner, or paid for by the Owner. The Contractor shall be liable for injuries and damages to persons and property suffered by reason of the Contractor's operations or any negligence in connection therewith.

##### **1-10.2 Traffic Control Plans**

The Contractor shall prepare a traffic control plan for the work activities. The plan shall show the necessary construction signs, flaggers, and other traffic control devices required for the project. The Contractor shall submit the plan to the Engineer for approval at least 20 calendar days in advance of the anticipated work.



**1-10.2(1) (Vacant)**

**1-10.2(2) (Vacant)**

**1-10.2(3) Conformance to Established Standards**

Flagging, signs, and all other traffic control devices furnished or provided shall conform to the standards established in the latest adopted edition of the "Manual on Uniform Traffic Control Devices" (MUTCD) published by the U.S. Department of State of Washington. Copies of the MUTCD may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington D.C. 20402. Modifications to the MUTCD for Streets and Highways for the State of Washington may be obtained from the Department of Transportation, Olympia, Washington 98504.

The condition of signs and traffic control devices shall be new, or "acceptable" as defined in the book *Quality Standards for Work Zone Traffic Control Devices*, and will be accepted based on a visual inspection by the Engineer. The Engineer's decision on the condition of a sign or traffic control device shall be final. When a sign or traffic control device becomes classified as "unacceptable" it shall be removed from the project and replaced within 12 hours.

The book, *Quality Standards for Work Zone Traffic Control Devices*, is available by writing to the American Traffic Safety Service Association, 5440 Jefferson Davis Highway, Fredericksburg, VA 22407, telephone (540) 898-5400, Fax (540) 898-5510.

**1-10.3 Flagging, Signs, and All Other Traffic Control Devices**

**1-10.3(1) Traffic Control Labor**

The Contractor shall furnish all personnel for flagging and for the setup and removal of all temporary traffic control devices and construction signs necessary to control traffic during construction operations. Prior to performing any traffic control work on the project, these personnel shall be trained with the video, "Safety in the Work Zone" produced jointly by WSDOT and Laborers' International Union of North America. The video is available from WSDOT's Engineering Publications Office, Transportation Building.

Flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, or Idaho. The flagging card shall be immediately available and shown upon request by the Owner. Workers engaged in flagging or traffic control shall wear reflective vests and hard hats. During hours of darkness, white coveralls or white or yellow rain gear shall also be worn. The vests and other apparel shall be in conformance with Section 1-07.8. During hours of darkness flagger stations shall be illuminated to ensure that flaggers can easily be seen without causing glare to the traveling public. The Contractor shall furnish the MUTCD standard Stop/Slow paddles (18 inches wide, letters 6 inches high, and reflectorized) for the flagging operations.

When the bid proposal includes an item for "Traffic Control Labor," the work covered by this item shall be limited to the labor required in the "work areas" defined in Section 1-10.5 for:

1. Flagging;
2. Handling the Class B construction signs and other temporary traffic control devices only for:
  - a. Set up and removal;
  - b. Relocation to and from temporary storage, provided that, the use and location of the temporary storage is approved by the Supervising Contractor;
  - c. Relocation on the project, provided that, the new locations are in accordance with the contract plans, approved traffic control plan, or the orders of the Supervising Contractor; and
  - d. Cleaning up and removing construction signs and traffic control devices on the project that are damaged or destroyed by a third party,
3. Operating the vehicle(s) described in Section 1-10.3(2) while transporting the Class B construction signs and other temporary traffic control devices; and
4. Cleaning the Class B construction signs, the other temporary traffic control devices, and the Class A construction signs, when they become illegible because of weather or other conditions and the Supervising Contractor orders them to be cleaned.
5. Spotters to warn work crews of impending danger from public traffic, when approved by the Supervising Contractor.

The hours eligible for "Traffic Control Labor" will be those hours actually used for the previously described work. Any work described under this section performed by a Traffic Control Supervisor will not be paid as "Traffic Control Labor" but will be covered by the item "Traffic Control Supervisor" per hour.

**1-10.3(2) Vacant**

**1-10.3(3) Construction Signs**

All signs required by the approved traffic control plan(s) as well as any other appropriate signs prescribed by the Supervising Contractor will be furnished by the Owner. The Contractor shall provide the posts or supports and erect and maintain the signs in a

clean, neat, and presentable condition until the necessity for them has ceased. All nonapplicable signs shall be removed or completely covered with either metal or plywood during periods when they are not needed. When the need for any of these signs has ceased, the Contractor, upon approval of the Supervising Contractor, shall take down these signs, posts, or supports. All posts or supports shall be removed from the project and shall remain the property of the Contractor. The Owner-furnished signs shall be returned to the Supervising Contractor in good condition. All such signs lost, stolen, damaged, or destroyed shall be replaced by the contractor in kind at the Contractor's expense or their value will be deducted from the Contractor's payments. Construction signs will be divided into two classes. Class A construction signs are those signs that remain in service throughout the construction or during a major phase of the work. They are mounted on posts, existing fixed structures, or substantial supports of a semi-permanent nature. Sign and support installation for Class A signs shall be in accordance with the Contract Plans or the Standard Plans. Class B construction signs are those signs that are placed and removed daily, or are used for short durations which may extend for one or more days. They are mounted on portable or temporary mountings. If it is necessary to add weight to the signs for stability, only a bag of sand that will rupture on impact shall be used. The bag of sand shall: (1) be furnished by the contractor, (2) have a maximum weight of 40 pounds, and (3) be suspended no more than 1 foot from the ground. In the event of disputes, the Supervising Contractor will determine if a construction sign is considered as a Class A or B construction sign.

When Class A or B construction signs are required, the work to provide these signs shall be:

1. Furnishing, removing, and disposing of the posts or supports for the signs;
2. Initial acquisition from the Supervising Contractor and ultimate return to the Supervising Contractor of the required Owner-furnished signs;
3. Initial installation and subsequent removal of both Class A and B construction signs; and
4. All other incidentals necessary for providing Class A or B construction signs according to the approved traffic control plan(s).

No item will be provided in the bid proposal for Class B construction signs. Payment for Class B construction signs will be limited to the labor cost to do the work described in Section 1-10.3(1). All other costs for the work to provide Class B construction signs shall be included in the unit contract price for the various other items of the work in the bid proposal.

Signs, posts, or supports that are lost, stolen, damaged, destroyed, or which the Supervising Contractor deems to be unacceptable, while their use is required on the project, shall be replaced by the Contractor without additional compensation.

#### **1-10.5 Payment**

The lump sum payment for "Traffic Control" shall be full payment for all costs for providing the work described in Sections 1-10.1, 1-10.2, and 1-10.3. The payment for the item will be made as follows:

- a) Providing traffic control plan and setup of signs and devices 20 percent of the total bid item.
- b) The remaining 80 percent to be paid on a prorated basis in accordance with the cooling pond work.

**DIVISION 2****EARTHWORK****2-01 CLEARING, GRUBBING, AND ROADSIDE CLEANUP****2-01.1 Description - Delete and replace with the following:**

The Contractor shall clear, grub and clean up those areas shown on the Plans.

"Clearing" means removing and disposing of all unwanted material from the surface, such as trees, brush, down timber, or other natural material.

"Grubbing" means removing and disposing of all unwanted vegetative matter from underground, such as sod, stumps, roots, buried logs, or other debris.

"Debris" means all nonusable natural material produced by clearing or grubbing.

**2-01.2 Disposal of Usable Material and Debris - Amend as follows:**

All organic debris and sod from clearing and grubbing shall be disposed of on-site at the direction of the Engineer.

**2-01.2(1) Disposal Method No. 1 - Open Burning - Delete this section.****2-01.3 Construction Requirements****2-01.3(1) Clearing - Delete and replace with the following:**

The Contractor shall:

1. Complete the clearing within the work area.
2. Fell trees with root structures within the work area.
3. Fell trees which are detrimental to the functionality of the surface water management system for the work area.
4. Close-cut parallel to the slope of the ground all stumps to be left in the cleared area outside of the work area.

**2-01.3(2) Grubbing - Delete and replace with the following:**

The Contractor shall:

1. Complete the grubbing work within the work area.
2. Grub deep enough to remove all stumps, large roots, buried logs, and other vegetative matter.
3. Grub all areas:
  - a. Shown on the plans.
  - b. To be excavated, including area staked for slope treatment.

- c. Where subdrainage trenches will be dug, unsuitable material removed or structures built.
- d. Upon area where embankments will be placed.

**2-01.3(4) Roadside Cleanup** - Delete this section.

**2-01.5 Payment** - Amend as follows:

"Clearing and Grubbing", Lump sum.

The Contract lump sum payment for "Clearing and Grubbing" shall be full payment for clearing and grubbing the site to the limits required by the Engineer and disposing of all material in designated on-site stockpiles. The estimated volume (5,700 CY) is the area shown on the plans multiplied by a 4-inch depth.

## **2-02 REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

**2-02.1 Description** -Delete and replace with the following:

The work described in this section includes removing and disposing of, or salvaging materials named in these special provisions or identified by the Engineer.

Demolition and removal of primary structures has been previously completed. However, structural components remaining include, but are not limited to, concrete foundations, walls, slabs, curb and gutter, sidewalks, equipment pedestals, and vaults. Other obstructions include fire hydrants, drain inlets, valve boxes, manholes, wood and metal fencing, wood and steel poles and bases, wood cribbing, and abandoned utility lines.

### **2-02.3 Construction Requirements**

**2-02.3(1) General Requirements** - Delete and replace with the following:

The Contractor shall raze, remove, and dispose of all structure components, fences, utility components, and other obstructions that lie wholly or partially within the footprint. All structural components and obstructions encountered shall be removed, hauled, and segregated into designated on-site stockpiles for further processing. Metal components will be stockpiled for future recycling; concrete components will be stockpiled for future use; wood components will be stockpiled for future chipping and disposal. Such work may include the breaking up or otherwise reducing the size of the materials in a manner acceptable to the Engineer.

It is estimated that 400 tons of structures and obstructions will be removed from within the work area limits.

### **2-02.3(2) Removal of Bridges, Box Culverts, and other Drainage**

**Structures -** Delete this section.

**2-02.3(3) Removal of Pavement, Sidewalks, and Curbs -** Delete this section.

**2-02.5 Payment -** Amend as follows:

Removal of structures and obstructions will be measured by the ton. Measurement shall be made on Owner-provided scales at the south end of the plant site prior to placing the materials in the designated stockpiles. The Scale operator will be provided by the Owner. Weight ticket will be provided to the Contractor.

"Removal of Structures and Obstructions ", will be paid for, per ton removed. The unit contract price per ton removed for "Removal of Structures and Obstructions" shall be full payment for removing all structures and obstructions encountered and disposing of all material in designated on-site stockpiles.

## **2-03 ROADWAY EXCAVATION AND EMBANKMENT**

**2-03.1 Description -** Delete and replace with the following:

This special provision covers the requirements for labor, supervision, equipment and materials associated with the earthwork operations shown on the Plans, or herein specified. Earthwork activities shall include, but not be limited to project layout, soil testing, site drainage, dust control, site preparation, excavation, excavation and disposal of any unsuitable materials encountered, subgrade preparation, fill and backfill, embankments, finish grading and site restoration.

All work described here must reasonably conform to the alignment, grade, and cross-sections shown in the Plans or established by the Engineer.

**2-03.3 Construction Requirements -** Delete and replace with the following:

**2-03.3(1) Grade Control and Layout of Work.**

The earthwork Contractor shall furnish all stakes, markers, tools and equipment required to lay out the work from bench marks and/or control point markers established by the Engineer. The earthwork Contractor shall not disturb existing survey monuments or bench marks without the consent of the Engineer. Markers that are accidentally disturbed by earthwork operations shall be replaced by the Owner at the Contractor's expense. The Owner and Contractor shall agree to the cost of reestablishing disturbed markers prior to the work being performed by the Owner.

**2-03.3(2) Inspection and Testing.**

During the course of the work, the Engineer will perform such tests as are required to identify materials, to determine compaction characteristics, to determine moisture content, and to determine density of the embankment in place. These tests performed by the Engineer will be used to verify that the embankment conforms to the requirements of the specifications and special provisions. Such tests are not intended to provide the Contractor with information required by him for the proper execution of the work and their performance shall not relieve the Contractor of the necessity to perform tests for that purpose.

The Owner may employ an independent laboratory for inspection and testing. The Owner will coordinate this testing with the Contractor, and the Contractor shall cooperate with the laboratory. The Owner will pay for these services. However, if initial testing indicates that the Contractor has not complied with the Contract Documents, then the costs of subsequent testing associated with the non-compliance will be deducted from the Contractor's monthly pay request.

**2-03.3(3) Protection and Safety**

**A. Open Excavations.** The earthwork Contractor shall provide barricades and/or other safety equipment as required to protect any equipment, vehicles and workers from any open excavations.

**B. Protection of Property.** The earthwork Contractor shall protect adjacent property and avoid damage to such property. Adjacent property damaged due to the earthwork Contractor's operations shall be repaired or replaced at no cost to the Owner or to the property owner. The repairs and/or replacement shall be equal to existing improvements and shall match existing finish and dimensions.

**2-03.3(4) Subgrade and Embankment Protection.**

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained in such a manner as to drain effectively at all times.

Finished subgrade shall not be disturbed by traffic or other operations and shall be protected and maintained by the earthwork Contractor until completion and acceptance of the work. The storage or stockpiling of materials on the finished subgrade will not be permitted.

**2-03.3(5) Site Drainage.**

Excavation, fill and backfill work areas shall be continually and effectively drained. Water shall not be permitted to accumulate in excavations or foundation areas for compacted fill. The earthwork Contractor shall construct suitable dikes, drains or provide pumping equipment, as required, to divert water flows away from the work areas.

**2-03.3(6) Dust Control.**

The dust produced from earthwork operations shall be controlled to prevent the spread of dust and to avoid creation of a nuisance in the surrounding area.

**2-03.3(7) Excavation****2-03.3(7) A. General Requirements.**

The earthwork Contractor shall excavate every type of material encountered within the limits of the footprint, to the lines, grades and elevations indicated.

Control staking will be set by the Engineer prior to construction to provide the Contractor with essential information for construction. The Contractor shall be responsible for the actual construction staking. Methods used shall be subject to approval of the Engineer, but shall not absolve the Contractor from responsibility for errors.

**2-03.3(7) C. Excavations for Cell Construction.**

1. The excavations shall be carried down to the elevations shown on the Plans. The subgrade shall be shaped to the line, grade, and cross-section shown in the Plans and compacted as specified. This work shall include plowing, discing, and any moistening or aeration required to obtain proper compaction. If suitable material in the bottom of the excavation is removed for the earthwork Contractor's convenience, the foundation shall be restored by the earthwork Contractor and at his expense, to a condition at least equal to the undisturbed foundation as determined by the Engineer.
2. It is estimated the volume of material to be excavated within the OCF footprint is 95,700 cubic yards.
3. The earthwork Contractor shall remove any surface layer of unsuitable material at the planned grade of the excavation, as determined by the Engineer, from the site and the cost thereof will be measured for payment, in accordance with Section 2-03.4, Measurement and Payment of these special provisions.

4. After the cell has been backfilled with source area soils and demolition debris, the temporary construction access road along the north side of the cell shall be removed. This work shall include the stripping and disposal, onsite, of the road surface course, as directed by the Engineer. The excavation of the road prism shall be to the line, grade, and cross-section shown in the Plans. Materials excavated from the road prism shall be placed onsite at the direction of the Engineer.

#### **2-03.3(7) D. Excavations for Ditches and Drainage Structures.**

Excavations for ditches and drainage structures shall be accomplished by cutting accurately the line, grade and cross section required. Trenches and pits shall be of sufficient size to accommodate the installation and the removal of piping and structures. Excessive open ditch excavation shall be backfilled with satisfactory materials to the grades shown on the Plans. The earthwork Contractor shall maintain all excavations free from detrimental quantities of brush, sticks, trash and other debris.

At each transition from cut to fill, the Contractor shall divert any drainage facility away from the embankment in natural ground. Ditches shall never permit water to flow into or upon embankment material.

#### **2-03.3(7) E. Seeps and Abandoned Utilities Found in Excavations.**

If the earthwork Contractor encounters seeps and/or abandoned utilities during excavation, he shall immediately notify the Engineer.

It is anticipated that water seeps will be encountered in the final slope face of the excavation. The Engineer shall evaluate and design the necessary drainage facilities to be constructed by the Contractor. Strip drains shall be installed to elevation 74 as shown in the Plans. The specification for the necessary facilities are described in Section 8-06 of these special provisions. A plan and narrative of the work to be performed will be provided to the Contractor after agency approval, if required, has been granted. The Contractor is cautioned that agency approval may result in some delay. Contractor should, therefore, anticipate such delay and deploy resources at other work or at locations on-site where necessary. Claims for delays or contract time extensions will not be allowed for this work. Payment for installing the seep drainage facilities shall be by force account as provided in Section 1-09.6 of the Standard Specifications.

It is anticipated that abandoned utilities will be encountered during excavation of the cell. Utility components within the excavation limits will be removed and disposed of on-site at the direction of the Engineer. Utility components that extend beyond the face of the cut slope shall be plugged or capped or may be required to be piped



beyond the limits of the footprint. The Engineer shall evaluate the conditions found in the field and will provide the Contractor, within 48 hours of the Contractor's notification, with a plan and narrative of the work to be performed. Payment for such work shall be by force account as provided in Section 1-09.6 of the Standard Specifications.

The plugging and capping may include: Plug pipe ends with concrete (concrete pipe and corrugated metal pipe), weld or hammer shut (steel pipe), cap (PVC and similar plastic pipe), or install blind flanges (ductile cast iron and HDPE).

#### **2-03.3(8) Borrow.**

##### **2-03.3(8) A General Requirements.**

Borrow is the excavation of material outside of the limits of the footprint as shown on the Plans or from Contractor-provided sites.

If the Contract Documents designate borrow materials are to be furnished by the Owner, the Contractor shall use those materials. Such borrow materials will be provided to the Contractor in stockpiles adjacent to the work. Borrow from other sources will be required only after stockpiled borrow materials are no longer available.

The earthwork Contractor shall load, haul, place, spread and compact the Owner-provided borrow materials from stockpiles as well as Contractor-provided off-site borrow materials for the construction of the earth berm embankment and in replacing unsuitable materials encountered during excavation.

##### **2-03.3(8) B Materials.**

Contractor-provided borrow materials shall meet the requirements of Section 9-03.14(3) of the Standard Specifications. The maximum particle size shall be limited to 3 inches.

#### **2-03.3(9) Embankment and Fill**

##### **2-03.3(9) A. General Requirements.**

The Contractor shall submit to the Engineer for approval, proposed equipment and construction methods to be used for the placement and compaction of embankment.

Embankment materials shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected

and approved by the Engineer. Embankment shall not be placed on a frozen surface, nor shall snow, ice, or frozen material be incorporated into the embankment.

OCF cell backfill materials, consisting of source area soils and demolition debris, shall not be placed until the final liner components have been inspected and approved by the Engineer. Cell backfill materials shall not be placed on a frozen surface, nor shall any frozen materials be incorporated in the backfill.

#### **2-03.3(9) B. Placement.**

1. The embankment foundation surface shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the embankment or otherwise acceptably scored and loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for embankment materials, and the surface materials of the foundation shall be compacted and bonded with the first layer of embankment as specified for subsequent layers of embankment. The earthwork Contractor shall place earth embankments in horizontal layers of uniform thickness. These layers shall run full width from top to the bottom of the embankment. Slopes shall be compacted to the required density as part of embankment compaction.

The distribution of materials throughout the embankment shall be free of lenses, pockets, streaks or layers of material differing substantially in texture, moisture content, or gradation from the surrounding material. Embankment materials shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified in Section 2-03.3(9)D.

If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the embankment to a depth not less than 2 inches before the next layer is placed.

During grading operations, the Contractor shall shape the surfaces of embankments and excavations to uniform cross-sections and eliminate all ruts and low places that could hold water. The top surfaces of embankments shall be maintained approximately level during construction, except that a cross-slope of approximately 2 percent shall be maintained to insure effective drainage. Contractor shall raise the inside edge of the embankment sufficiently above the outside edge of the lift, thus promoting drainage away from the cell. When the surface of the embankment intersects a side hill, the surface shall be sloped away at a rate not to exceed 20:1.

2. The cell backfill materials shall be placed in 12 inch (loose) lifts, spread uniformly across the area being backfilled resulting in a homogeneous mass prior

to compaction. Each lift shall be watered, if necessary, and compacted to 90% of standard Proctor maximum dry density. The cushion course placed across the top of the backfill, prior to placement of the cell cap, shall be compacted to ensure that the top 12" of the course is compacted to 95 percent of the standard maximum dry density. Field density and moisture content tests will be performed as the backfill operations proceed.

#### **2-03.3(9) C. Materials.**

1. Embankment materials for constructing earth embankments are those materials obtained from on-site excavation, Owner-provided borrow, or Contractor-provided off-site borrow. Final acceptance of all embankment materials will be determined by the Engineer.
2. The OCF cell backfill materials shall consist of materials from source area excavations and demolition debris. Backfill materials shall be processed and screened to provide for two (2) gradations of materials. One gradation requires that 100% of the backfill material pass a 3/4" screen. The second gradation requires 100% of the material to pass a 6" screen. It is anticipated that demolition debris and concrete found in the source areas will require size reduction operations to meet the required gradations.

The backfill materials passing the 3/4" screen shall limit fines to 10% and shall act as a cushion course between the installed liner systems, including the cell cap, and the larger graded backfill materials placed in the center of the cell. This material shall be placed adjacent to and to a minimum depth of 12" perpendicular to the liner systems along the bottom and the sides of the cell and shall have a 10' height restriction. The cushion course shall be a minimum depth of 3 feet across the top of the placed source area soils and demolition debris. The material passing the 6" screen shall be placed inside the cushion courses.

#### **2-03.3(9) D. Compacting Earth Embankments.**

Each layer of the entire OCF cell embankment shall be compacted to 95 percent of the maximum density as determined by the compaction control tests described in Section 2-03.3(9)F of these special provisions.

In the top 2 feet, horizontal layers shall not exceed 4 inches in depth before compaction. No layer below the top 2 feet shall exceed 8 inches in depth before compaction.

The Contractor shall use compaction equipment approved by the Engineer.

### 2-03.3(9) E. Moisture Content.

Within the limits described below, the Contractor shall adjust moisture content during compaction to produce a firm, stable embankment. The Contractor shall not begin compaction until the moisture content is so adjusted.

The optimum moisture content is defined as, "That moisture content which will result in a maximum dry unit weight of the soil when subjected to the ASTM D 698, Standard Proctor Compaction Test" (WSDOT Test Method 606/AASHTO T99 Method A). The maximum dry weight, in pounds per cubic foot, obtained by the above procedure is the Proctor maximum dry density.

All fill materials to be placed in the embankment shall be compacted within the range of three (3) percentage points below to two (2) percentage points above optimum. Where the layer of embankment must be moisture conditioned before compaction, uniformly apply water to surface of the layer to prevent free water appearing on the surface during or subsequent to compaction operations. The water shall be mixed into the embankment materials adequately to provide a uniform moisture content throughout the uncompacted layer.

Remove and replace, or scarify and aerate, embankment materials too wet to permit compaction to the specified density.

The Engineer may permit the Contractor to place materials having a higher moisture content than specified if:

1. The material consists of free-draining rock, gravel, or sand that produces a firm, stable embankment;
2. The excess moisture will not impair the embankment; and
3. EPA approval is granted.

However, the Engineer may at any time require the Contractor to return to normal moisture-content specifications.

All costs of drying (scarifying and aerating) embankment materials shall be considered incidental to other items of work.

If weather prevents drying excavation or borrow materials to the required moisture content, the Engineer may order the Contractor to alter normal procedures or equipment to prevent damage to the partial or complete embankment.

The Contractor shall repair at no expense to the Owner any partial or complete embankment that loses stability because of continued hauling across it. Evidence of lost stability shall include pumping or rutting. The Contractor shall also alter hauling equipment or procedures to prevent further damage.

If it appears that rain or snow will soak an area that has been placed and compacted, the Contractor shall temporarily seal it against the weather. Should the Contractor fail to do so, any additional work required to restore the area to its previous condition shall be done at no expense to the Owner.

#### **2-03.3(9) F. Compaction and Moisture Control Tests.**

Maximum density for materials with 30 percent or more, by mass, retained on the U.S. No. 4 sieve shall be determined using WSDOT Test Method No. 606. The maximum density and optimum moisture for materials with less than 30 percent, by mass, retained on the U.S. No. 4 sieve shall be determined using AASHTO T99 Method A.

In place density and moisture content will be determined using WSDOT Test Method No. 613.

The Engineer will inform the earthwork Contractor when the placement moisture content is near or exceeds the limits of uniformity specified above, and the Contractor shall immediately make adjustments in procedures as necessary to maintain the moisture content within the specified limits.

#### **2-03.4 Measurement and Payment - Delete and replace with the following:**

Excavation for cell construction and the removal of the temporary construction access road will be measured by the cubic yard. Material will be measured in its original position by cross-sectioning or through the use of digital terrain modeling survey techniques. In excavation, pay quantities will be computed to the neat lines of the cross-sections.

"Excavation for Cell Construction" or "Removal of Temporary Construction Access Road" will be paid for, per cubic yard. The contract unit price shall be full compensation for excavating, loading, hauling, placing, or otherwise disposing of the material.

Excavation of unsuitable materials will be measured by the area denoted by the Engineer, times the depth of excavation and converted to cubic yards.

"Excavation of Unsuitable Materials" will be paid for, per cubic yard. The unit contract price per cubic yard for "Excavation of Unsuitable Materials" shall be full compensation for excavating, loading, hauling, and disposing the material in an on-site stockpile.

Common borrow, if required, will be measured by the ton. Moisture content above +3 percent of optimum moisture will be deducted from the pay quantities.

"Common Borrow" will be paid for, per ton. The unit contract price per ton for "Common Borrow" shall be full compensation for excavating, loading, hauling, placing, or otherwise depositing the material on-site as directed. This price includes pay for permits, royalties, removing from the borrow site, disposing of, wasting or stockpiling any material not suitable for embankment, and borrow site reclamation.

Embankment construction and compaction will be measured by the cubic yard, to the neat lines of the staked cross-sections of compacted embankment. No allowance will be made for material that settles.

"Embankment Construction and Compaction" will be paid for, per cubic yard. The unit contract price per cubic yard for "Embankment Construction and Compaction" shall be full compensation for all material, labor, tools, equipment, and incidentals required. The quantities for embankment construction and compaction shown in the proposal are estimates only. The Engineer will be the sole judge of the actual quantities needed.

Backfill materials placed in the cell will be measured by the cubic yard, to the neat lines of the staked cross-sections of compacted embankment. No allowance will be made for material that settles.

"OCF Cell Backfill" will be paid for per cubic yard. The unit contract price per cubic yard for "OCF Cell Backfill" shall be full compensation for all labor, tools, equipment, and incidentals required. The quantity shown in the proposal is the volume of the cell computed electronically to the limits denoted on the Plans.

**2-03.5 Payment** - Delete this section.

## **2-06 SUBGRADE PREPARATION**

**2-06.1 Description** - Delete and replace with the following:

The subgrade will be considered as those areas and surfaces upon which additional materials are to be placed under this contract, or which are to be constructed or prepared for the future placement thereupon of other material in accordance with the Standard Specifications and these special provisions.

All work shall be in accordance with the Contract Documents and constructed to the lines, grades, and typical cross-sections indicated in the Plans or as established and staked by the Engineer.

**2-06.3 Construction Requirements**

**2-06.3(1) Subgrade for Surfacing** - Delete and replace with the following:

**1. General Requirements.** Subgrade shall be shaped to the line, grade and cross section and compacted as specified. This operation shall include plowing, discing and any moistening or aeration required to obtain proper compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory material as directed by the Engineer.

Low areas resulting from the removal of unsatisfactory material shall be brought up to the required grade with satisfactory materials, and the entire subgrade shall be shaped to the line, grade and cross-section and compacted as specified.

The foundation for the placement of embankment shall be prepared by leveling, moistening, and rolling so that the surface materials of the foundation will be as compact and will provide as satisfactory a bonding surface with the first layer of embankment as specified for the subsequent layers of embankment.

After rolling, the elevation of the finished subgrade shall not vary more than 0.2 foot from the established grade and approved cross-section.

**2. Compaction.** Compact the subgrade to a depth of 6 inches. Compaction accomplished by sheepsfoot rollers shall be not less than 95 percent of the Standard Proctor maximum dry density (WSDOT Test Methods 606/AASHTO T99 Method A or ASTM D 698).

**2 06.3(2) Subgrade for Pavement - Delete this section.**

**2-06.5 Measurement and Payment - Delete and replace with the following:**

This work is to be considered incidental to other items of work. No measurement or payment will be made for this work.

## **2-11 TRIMMING AND CLEANUP**

**2-11.1 Description - Delete and replace with the following:**

The Contractor shall, as directed by the Engineer, remove from the Owner's property and from all public and private property, at his own expense, all temporary structures, rubbish, and waste materials resulting from his operations.

**2-11.3 Construction Requirements - Delete and replace with the following:**

Throughout the period of construction, the Contractor shall keep the site clean and free from all rubbish and debris and shall promptly clean up all or any portion of the site when notified to do so by the Engineer. Care shall be taken to prevent spillage on the streets over which hauling is done, and any such spillage or debris deposited on streets due to Contractor's operations shall immediately be cleaned up. The Contractor shall promptly remove from any parts of the working area all unused materials, surplus earth and debris. Uncontaminated materials shall be removed from the site at the Contractor's expense. Contaminated materials shall be disposed of on-site in stockpiles designated by the Engineer. Materials may require size reduction prior to placement in stockpiles. Construction areas shall be left in a clean, neat and acceptable condition at the earliest time following completion of the portion of the work.

In the event that the Contractor fails to comply with the orders of the Engineer regarding clean-up, the Engineer may require the Contractor to cease progress on any or all parts of the work under the Contractor until the unsatisfactory condition is corrected. If the Contractor does not respond in a timely manner, the Engineer may order such clean-up work performed by others and the costs therefore deducted from payment due the Contractor. No additional compensation will be allowed as a result of such suspension.

During all phases of the construction work, the Contractor shall take precautions to abate a dust nuisance or a wind blown sand nuisance, by clean-up, sweeping, sprinkling with water, or other means as necessary to accomplish result satisfactory to the Engineer.

Upon completion of the work and prior to final inspection, the entire site of operations shall be cleared of equipment, unused materials and rubbish, so as to present a clean and neat appearance.

**2-11.4 Measurement and Payment - Delete and replace with the following:**

This work is to be considered incidental to other items of work. No measurement or payment will be made for this work.

**2-11.5 Payment - Delete this section.**



**DIVISION 5****SURFACE TREATMENTS AND PAVEMENTS****5-06 ACCESS ROAD SURFACING - Add the following new section:****5-06.1 Description**

This work shall consist of constructing one or more layers of processed surfacing course on the temporary construction access road in accordance with these special provisions and in conformity with the lines, grades, depth, and typical cross-section shown on the Plans or as established by the Engineer.

**5-06.2 Materials**

Processed Surface Course shall meet the requirements of WSDOT Standard Specification 9-03.9(3) for Crushed Surfacing Base Course. Crushed surfacing shall be manufactured from ledge rock, talus, or gravel in accordance with the provisions of Section 3-01. The materials shall be uniform in quality and substantially free from wood, roots, bark, and other extraneous material and shall meet the following test requirements:

Los Angeles Wear, 500 Rev. 35% max.  
 Degradation Factor — Top Course 25 min.  
 Degradation Factor — Base Course 15 min.

Crushed surfacing of the various classes shall meet the following requirements for grading and quality when placed in hauling vehicles for delivery to the roadway, or during manufacture and placement into a temporary stockpile. The exact point of acceptance will be determined by the Engineer.

<b>Base Course</b>	<b>Top Course and Keystone</b>	<b>Sieve Size Percent Passing</b>
1-1/4" square	100	
3/4" square		100
5/8" square		50-80
1/4" square	30-50	55-75
U.S. No. 40	3-18	8-24
U.S. No. 200	7.5 max	10.0 max.
% Fracture	75 min.	75 min.
Sand Equivalent	35 min.	35 min.

All percentages are by weight.

The fracture requirement shall be at least one fractured face and will apply to material retained on each specification sieve size U.S. No. 10 and above if that sieve retains more than 5 percent of the total sample. The portion of crushed surfacing retained on a 1/4-inch sieve shall not contain more than 0.15 percent wood waste.

#### **5-06.3 Construction Requirements**

The asphaltic and gravel materials shall be uniformly spread upon the prepared access road subgrade to the depth, width, and cross-section shown on the Plans. Construction methods used shall meet the applicable requirements of Section 4-04.3 of the Standard Specifications.

#### **5-06.4 Measurement and Payment**

Measurement will be made by the number of cubic yards of Processed Surfacing Course placed and approved by the Engineer. The volume will be computed to the neat lines of the plan cross-section times the length of the access road. Water used for compaction is to be considered incidental to the work and will not be measured for payment.

Payment will be made for "Processed Surfacing Course", per cubic yard. Such price shall be full compensation for furnishing all materials, labor, tools, equipment, and other incidental work necessary to complete the work.

**DIVISION 7****DRAINAGE STRUCTURES, STORM SEWERS, SANITARY SEWERS,  
WATER MAINS AND CONDUITS****7-01 DRAINS****7-01.1 Description** - Add the following:

This work also consists of construction of temporary dewatering facilities, the cell cap subsurface drainage system, and the cap pathway drainage system as shown and detailed on the Plans.

**7-01.2 Materials** - Add the following:

The drain pipe and underdrain pipe shall be Hi-Q pipe as manufactured by Hanker, Inc., 401 Olive Street, Findlay, OH 45840, Telephone 1-800-242-6267, or an approved equal.

The product supplied shall be a high density polyethylene corrugated exterior / smooth interior pipe.

Coupling bands shall cover at least one full corrugation on each section of pipe. All coupling bands shall meet or exceed the soil-tightness requirement of the ASHTO Standard Specification for Highway Bridges, Section 23, paragraph 23.3.1.5.4(e).

**7-05 MANHOLES, INLETS, CATCH BASINS, AND DRYWELLS****7-05.2 Materials** - Add the following:

Pathway drain inlet shall consist of a Nyloplast 12" x 12" Model H-20 storm drain inlet, as manufactured by Advanced Drainage Systems, 3300 Riverside Drive, Columbus, OH 43221, Telephone 614-457-3051, or an approved equal.

**DIVISION 8**  
**MISCELLANEOUS CONSTRUCTION**

**8-01 EROSION CONTROL**

**8-01.1 Description** - Add the following:

This work shall be performed after the erosion control matting has been placed and accepted on the outside slopes of the OCF cell. Installation of the erosion control matting is outlined in Section 8-34 of these special provisions.

**8-01.3(2) Topsoil** - Add the following:

Topsoil for this work shall be Topsoil Type C.

**8-01.3(4) Seeding** - Add the following:

Hydroseeding is the only acceptable method of seeding on the slopes of the cell.

**8-01.4 Measurement** - Add the following:

Measurement for "Hydroseeding" will be by ground slope measurement in acres of actual area hydroseeded as approved by the Engineer.

**8-01.5 Payment** - Add the following:

"Hydroseeding", per acre.

The unit contract price per acre for "Hydroseeding" shall be full compensation for all costs necessary to prepare the area, hydroseeding the areas as shown, and for furnishing all labor, tools, equipment, and materials necessary to complete the work as specified.

Any incidental work required to complete the hydroseeding as specified herein but not specifically mentioned, shall be incidental to, and all costs thereof shall be included in the unit contract price.

**8-04 CURBS, GUTTERS, AND SPILLWAYS**

**8-04.1 Description** - Add the following:

This work includes replacing the existing driveway opening on the east side Bennett Street with cement concrete barrier curb and gutter. Limits of the new curb and gutter will be marked in the field. Removal of the existing driveway is described in Section 2-02 Removal of Structures and Obstructions of these special provisions.

**8-06 OCF CELL SLOPE SUBDRAIN SYSTEM - Add the following new section:****8-06.1 Description**

It is anticipated that water seeps may be found along cut slopes during the excavation of the OCF cell. This work shall consist of furnishing and installing panel-shaped geocomposite drains in trenches on slopes, furnishing and installing a horizontal subdrain collector pipe, and excavating and backfilling the trenches in accordance with the Plan details and this special provision. The Engineer will determine the limits of the complete drain system.

**8-06.2 Materials**

Materials shall meet the requirements of the following sections:

Aggregates	9-03.13, 9-03.16 & 9-03.17	(SS) (SS)
Geocomposite Slope Drain	9-05.22	(SP)
Horizontal Subdrain Collector	9-05.21	(SP)

**8-06.3 Submittals**

The Contractor shall submit 2 copies of the following:

1. Samples and a complete description of the geocomposite slope drain, fittings for connecting separate pieces of the geocomposite slope drain, and transition fittings.
2. A description of how the trench drains will be constructed. This will include a description of the equipment used to install trenches on 3 horizontal to 1 vertical (3:1) slopes, the method of installing the geocomposite slope drain in the trench, and the method of backfill and compaction.

The Contractor shall furnish written instructions for storage and handling of the geocomposite slope drain and fittings a minimum of 7 days prior to shipment of the material to the Site.

**8-06.4 Construction Requirements****8-06.4(1) Geocomposite Drain**

The exact location, sequence of placing the slope drains, and the depth of each trench will be determined by the Engineer in the field.

Each slope trench shall be excavated a maximum of 4 inches wide to the depth denoted by the Engineer.

The geocomposite slope drain shall be installed in the trench as shown on the Plans. The Contractor shall provide the means to hold the panel flush against the trench wall during backfilling.

The slope trench shall be backfilled with sand as specified. Backfill shall be compacted in 1-foot lifts, using equipment designed for backfilling in narrow trenches, without damaging the geocomposite materials.

Fittings and transition fittings shall be installed before placing the geocomposite drain in the trench.

#### **8-06.4(2) Horizontal Subdrain Collector Drain**

The location of the horizontal slotted subdrain collector and the subdrain outlet pipe will be determined by the Engineer in the field.

The trench shall be excavated, lined with a non woven geotextile as specified in Section 9.33.1(3), and backfilled with bedding materials (WSDOT 9-03.16) and gravel backfill (WSDOT 9-03.17, Class B) as shown on the Plans.

The upstream end of the HDPE pipe shall be capped prior to placement in the trench.

The slotted pipe shall be placed in the seep interception trench that parallels the cell walls. The solid pipe shall be placed below the berm of the cell, connecting the slotted pipe to the storm water outfall, as staked by the Engineer.

The installation of the HDPE pipe shall be performed such that the HDPE pipe segments and fittings will be fusion welded together, as necessary, to form a continuous conduit and it will not be telescoped or damaged to the extent that its drainage efficiency will be impaired when completed.

The subdrain pipes shall be installed in the trench to the line, grades and elevations staked in the field and backfilled, as detailed on the Plans.

#### **8-06.5 Measurement**

The length of geocomposite slope drain, slotted subdrain collector pipe, and subdrain outlet pipe will be the number of linear feet of completed installation measured along the invert. Pipe or drain in excess of the length designated by the Engineer will not be measured or paid for.

Excavation of the pipe trench will be measured as structure excavation Class B by the cubic yard as specified in Section 2-09 of the Standard Specifications. Excavation of the slope trench will be measured by the linear foot of trench staked by the Engineer times the specified width and depth and converted to cubic yards.

Gravel and sand backfill for the drains and pipe will be measured by the volume placed within the neat line limits of the structure excavation or the limits of the slope drain as specified on the Plans.

#### **8-06.6 Payment**

Payment will be made in accordance with Section 1-04.1 of the Standard Specifications, for each of the following bid items that are included in the proposal:

"Slotted Subdrain Collector Pipe \_\_\_\_\_ In. Diam.", per linear foot.

"Subdrain Outlet Pipe \_\_\_\_\_ In. Diam.", per linear foot.

"Geocomposite Slope Drain", per linear foot.

"Gravel Backfill for Subdrain", per cubic yard.

"Sand Backfill for Slope Drain", per cubic yard.

"Structure Excavation Class B", per cubic yard.

"Structure Excavation for Slope Drain", per cubic yard.

### **8-12 CHAIN LINK FENCE AND WIRE FENCE**

#### **8-12.2 Materials - Add the following:**

All fencing and gates shall conform to the specifications for Type I, modified by the addition of three strands of barbed wire making the total fence height equal to 7 feet.

#### **8-12.3(1) F Barbed Wire - Add the following new section:**

Barbed wire brackets shall be installed on each post at 45° from vertical and facing away from the smelter site. Secure barbed wire to each bracket after tightening.

### **8-15 RIPRAP**

#### **8-15.3(6) Quarry Spalls - Add the following paragraph to this section:**

Quarry spalls shall be placed after a ~~4.5 ounce/square yard~~ non-woven ditch lining geotextile meeting WSDOT 9-33.2, Table 4 has been placed longitudinally in the ditches or on the slope.

Quarry spalls shall be placed as shown on the plans and in such a manner that all relatively large stones shall be essentially in contact with each other, and all voids filled with the finer materials so as to provide a well graded compact mass. The quarry spalls shall be dumped in such a manner as will ensure the spalls coming to their specified thickness. When placing rock materials, care shall be taken not to disturb or damage underlying materials or improvements.

**8-30 OCF LINER INSTALLATIONS** - Add the following new section:**8-30.1 Description**

This work shall consist of constructing a bottom liner system and a cover system within the constructed OCF cell in accordance with these special provisions and details shown on the Plans. The bottom liner system shall consist of a composite bottom liner, a leak detection, collection and removal system, a composite top liner, and a leachate collection and removal system. The cover system shall consist of a composite low hydraulic conductivity layer, a drainage layer, and a top cover layer.

Liner installation in the bottom of the cell shall be in the following order:

- a. Composite bottom liner
  - 3' thick compacted soil layer
  - 60-mil textured (both sides) HDPE flexible membrane liner (FML)
  - 16 oz. nonwoven cushion geotextile
- b. Leak detection, collection and removal system (LDCRS)
  - 12" minimum granular drainage material layer with liquid removal devices
  - 6 oz. nonwoven separation geotextile
- c. Composite top liner -
  - 1' thick compacted soil layer
  - 60-mil textured (both sides) HDPE FML
  - 16 oz. nonwoven cushion geotextile
- d. Leachate collection and removal system (LCRS)
  - 12" minimum granular drainage material layer with liquid removal devices.
  - 6 oz. nonwoven separation geotextile

Liner installation on the sides of the cell shall be in the following order:

- a. Composite bottom liner
  - 3' thick compacted soil layer
  - 60-mil textured (both sides) HDPE FML
- b. Leak detection, collection and removal system (LDCRS)
  - geocomposite drainage net layer with liquid removal devices conduit



## c. Composite top liner -

- geosynthetic clay liner (GCL)
- 60-mil textured (both sides) HDPE FML

## d. Leachate collection and removal system (LCRS)

geocomposite drainage net layer with liquid removal devices conduit

The cover system installation shall be in the following order:

## a. Composite low hydraulic conductivity layer

- 2' thick compacted soil layer
- 40-mil textured (both sides) HDPE FML
- 16 oz. nonwoven cushion geotextile

## b. Drainage (biotic) layer

- 12" minimum granular drainage material layer
- 6 oz. nonwoven separation geotextile

## c. Top cover

- minimum of 2' of soil capable of sustaining plant species
- vegetation.

### 8-30.2 Materials

Materials shall meet the requirements of the following sections:

Bentonite	9-34	(SP)
Flexible Membrane Liner	9-35.1	(SP)
Cushion Geotextile	9-33.1(1)	(SP)
Aggregates	9-03.16 & 9-03.1(3)C	(SS)
Separation Geotextile	9-33.2 Table 3	(SS)
HDPE Drainage Pipe	9-05.21	(SP)
Geocomposite Drainage Net	9-33.1(2)	(SP)
Geosynthetic Clay Liner	9-35.3	(SP)
Cover Soil	9-14.1(3)	(SS)

### 8-30.3 Construction Requirements

#### 8-30.3(1) General

Before commencing the work specified under this section, the Contractor shall submit to the Engineer for his review and approval, within 5 working days of received Award of Contract, as stated in Sections 1-05 and 1-06 of the Standard Specifications, 2 copies of all installation drawings, procedures, and a schedule for carrying out the work, for all geosynthetic materials to be supplied. This submittal shall also include the sizes and

weights of all proposed equipment, operating methods, and proposed protection measures for operating any equipment on each of the liner components. Shop drawings shall have sheet layouts with proposed size, number, position and sequence of placing all field joints and the direction of the shop joints on each sheet. Shop drawings shall also show complete details and/or methods for anchoring the specific liner component at the edges, making field joints and repairing damaged materials.

Materials delivered to the Site shall be inspected by the Engineer for damage, unloaded and stored with a minimum amount of handling. Materials shall not be stored directly on the ground. During shipment and storage, all components shall be wrapped in the factory sealed heavy-duty protective covering. It is essential that the rolls of the geosynthetic clay liner provided be kept dry until covered with the HDPE FML. The storage area shall be such that the supplied components are protected from vandalism, mud, soil, dust and debris. Materials that are not to be installed immediately shall not be stored in the direct sunlight.

The Engineer reserves the right to perform acceptance tests on samples of the component materials prior to acceptance. In addition, as soon as the component material arrives on-site, samples will be randomly selected by the Engineer and submitted for testing to confirm that the right material was received and that it meets the property values specified.

The supplier(s) of geosynthetic materials to be incorporated into the OCF cell shall provide a technical representative on the jobsite that has previously installed a minimum of 2 million square feet of the specific component in similar containments, to ensure compliance with the manufacturer's directions for handling and installation. The technical representative shall be present when the specific component installation is started and whenever the component is being installed. The technical representative shall observe the work and shall report unsatisfactory conditions to the Engineer and shall make recommendations for improvements to the Contractor.

The technical representative shall inspect the surface upon which the specific component is to be installed for acceptability and shall provide the Engineer with written certification that the component was installed in accordance with the manufacturer's recommendations.

### **8-30.3(2) Preparation of the Cell**

Prior to the installation of liner components, the bottom and sides of the OCF cell shall be shaped to the line, grade, and cross-section and compacted as specified. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory material as directed by the Engineer. Areas requiring the removal of unsatisfactory materials shall be brought up to the required line, grade and cross-section and compacted as specified. The slope of the finished subgrade upon which the liners will

be installed shall not be less than the specified slope for the bottom portion of the cell and not more than the specified slope for the side slope portion.

The face and floor of the cell shall be scarified just prior to the placement of the first lift of the compacted soil.

The finished installation of each layer must be inspected and approved by the Engineer prior to the placement of the next succeeding layer.

### 8-30.3(3) Liner Construction

#### 8-30.3(3)A Materials

1. Contractor provided import materials to be used in the admix for the composite bottom, low hydraulic conductivity layers must be consistent with the materials used for the construction of the test pad.

Materials shall consist of one inch minus or ¼ inch minus silty sand meeting the gradation requirements presented in Table 8-30-1. Rock fragments having maximum dimensions of more than 1" inch shall not be placed in the layer. Rock fragments found in the stockpiled materials shall be removed prior to mixing with the bentonite admixture. The Contractor shall supply representative bulk samples (ten 5-gallon buckets) to the Engineer for pre-construction testing. The pre-construction testing program will take about 2 months to complete.

**Table 8-30-1 Import Material for Low-permeability Liner**

1" Minus Material	
U.S. Sieve Size	% passing
1"	100
3/8"	95-100
#10	90-100
#20	88-100
#50	80-95
#100	64-88
#200	35-45

OR

1/4" Minus Material	
U.S. Sieve Size	% passing
1/4"	100
#10	95-100
#20	92-100
#50	85-95
#100	70-90
#200	35-45

The Owner will provide 1" minus borrow materials for the top low hydraulic conductivity layer. The materials will be located in stockpiles placed within 1000 feet of the OCF Work Area.

2. Drainage materials to be used above the flexible membrane liners shall be obtained from an off-site borrow source approved by the Engineer. The Engineer shall approve the source of the material based on test results provided by the Contractor. Tests shall be performed by an approved soils laboratory. Tests required for materials acceptance include, but are not limited to gradation, permeability and standard Proctor optimum density, and a permeability/density curve established for the material submitted. The drainage materials in-place shall have a hydraulic conductivity of 10 cm/sec or greater.

The drainage material shall consist of rounded to subrounded gravels having a particle size no larger than 1-1/2 inches. The gradation shall comply with Grading No.2 for coarse aggregate for concrete as noted in the Standard Specifications. The material shall be durable and sound, free from lumps and balls of clay, organic matter, and other deleterious substances. Material containing sharp, jagged rock, roots, debris or any other material which may be abrasive to or may puncture the flexible membrane liner shall not be used.

3. Cover soil shall consist of Topsoil Type C as outlined in these special provisions. The material shall be imported from an off-site source approved by the Engineer.

### **8-30.3(3)B Construction Sequence**

#### **A. General**

The intent of the admix program is to obtain a low-permeability soil by mixing materials with bentonite to obtain an in-place permeability of  $1 \times 10^{-7}$  cm/sec or less.

The Contractor will construct a 100-foot-long test section in the OCF cell area with the selected design mix from the pre-construction testing program (Section 8-30.3(3)A). The same procedures and equipment utilized to construct the 1999 SDRI

test pad will be used to construct the test section. Each compacted lift of material placed in the test section will be sampled and tested by the Engineer.

Field results will be plotted on dry unit weight versus compaction water content curve along with a plot of the line of optimums and zero air voids curve developed from the results of the laboratory tests.

Based on the results of the 1999 SDRI test pad, the laboratory pre-construction testing program described in Section 8-30.3(3)A and previous experience, the performance criteria for constructing the low-permeability test section will be based on the following:

- Bentonite rates (based on dry weight) at 8% for 1-inch minus or at 7% for ¾-inch minus material meeting the gradation requirements presented in Table 8-30-1;
- Five cycles (each forward and backward pass equals one cycle) with the same or equivalent compaction equipment (Caterpillar Model CP-563C Vibratory Soil Compactor) used for the SDRI Test Fill;
- Dry unit weights greater than 94 percent of the maximum dry density as determined by ASTM D 698;
- Compaction water content on or above the established line of optimums; and
- $P_o$  greater than or equal to 80%, where  $P_o$  is defined as the number of water content/dry unit weight points above the line of optimums divided by the total number of water content/dry unit weight measurements multiplied by 100%.

The tube samples recovered from each compacted lift will be tested by the Engineer for hydraulic conductivity (ASTM D 5084) at a rate of four per lift to verify that the field criterion of  $1 \times 10^{-7}$  cm/sec has been achieved.

It has been shown by previous experience that when most of the field compaction data points lie on or above the line of optimums, there is a high probability that field hydraulic conductivity results will be  $1 \times 10^{-7}$  cm/sec or less. This is especially true when the  $P_o$  is greater than 80%. The minimum unit weight criterion (94% relative standard compaction) is specified to remold clods, eliminate inner clod voids and ensure design shear strength. The results from the test section will be used to specify placement and construction of the remaining compacted low-permeability liner in the OCF.

The Contractor meeting all of the above criteria shall be allowed to proceed with OCF liner construction while the laboratory hydraulic conductivity test are being performed.

The in-place compacted permeability is sensitive to the homogeneity of the admix process, and the curing time between admixing and placement. Therefore, the Contractor will provide an admix process that obtains complete and uniform mixing of the materials, and allows adequate curing time (minimum of 24 hours) such that the

required permeability is achieved when placed at the specified moisture and percent relative compaction.

The admix plant shall be a pugmill-type plant using either a batch or continuous mixing process that allows the mix proportions and mixing time to be controlled. The mixing operation shall be consistent with the process used for the construction of the test pad.

The plant shall contain screens capable of screening material larger than 1 inch in diameter. The plant shall include storage bins of sufficient capacity to supply the mixer when it is operating at full capacity. Water shall be added in a controlled amount to the materials being admixed to obtain the specified moisture range for the low-permeability layer. (The quantity of water added may change as experience is gained in the work, with the objective of having the most desirable moisture content during placement to achieve the required permeability without having to add additional water or to dry the material). The Contractor shall provide means for checking the amount of water being added at the plant. The measuring device shall be accurate to within 0.5 percent.

The requirements for batch plants are as follows:

The equipment shall include means for accurately weighing each soil material (screened Owner-provided materials and bentonite) in a weight box or hopper suspended on scales and of ample size to hold a full batch without hand raking or running over. Automatic weight proportioning devices shall be provided. No material will be allowed to leak into the mixer while a batch is being weighed. The weight shall be accurate to within 0.5 percent. Batch weights shall be corrected for moisture contents of the materials.

The batch mixer shall be capable of producing a uniform mixture. The clearance of the blades from all fixed and moving parts shall not exceed 1 inch.

The plant shall be capable of regulating the mixing time in 5-second increments.

The requirements for continuous mix plants are as follows:

The plant shall include a means for accurately (within 0.5 percent) proportioning the materials to be blended.

The plant shall include a means for calibration of the feeder-gate openings by weighing test samples. Provisions shall be made so that materials fed out of the bins may be bypassed to individual test boxes.

The mixer shall be capable of producing a uniform mixture. The clearance of the blades from fixed and moving parts shall not exceed 1 inch.

The plant shall be capable of controlling the mixing time. The mixing paddles shall be adjustable for angular position on the shafts and reversible to retard the mix flow.

The Contractor shall install each component in accordance with the Plans and the manufacturer's specifications.

All geosynthetic materials shall be deployed free of wrinkles and folds. On slopes, the materials shall be anchored at the top and unrolled down the slope. In the presence of wind, all materials shall be weighted with sandbags or other materials which will not damage the geosynthetics.

During installation of any geosynthetic component, the edges of the material shall be anchored as detailed on the Plans. The ends of the material shall be protected during placement to prevent the damage to the component prior to seaming, attachment, or anchoring of the edges by use of sandbags or other approved methods. Materials, equipment or other items shall not be dragged across the surface of the component or be allowed to slide down slopes of the component. All parties walking on any component shall wear soft soled shoes. Smoking will not be permitted within the cell during any liner component installation.

All components shall be installed in a relaxed condition and shall be free of tension or stress upon completion of the installation. Stretching of components will not be allowed. The components shall be laid without folds which could cause excessive stress or deformation. Care shall be taken not to disturb any seams during subsequent layer placements.

Any necessary repairs shall be made with the component material itself. Patches shall be cut so as to cover the area to be repaired by a minimum of 6" in all directions for FMLs and 12" in all directions for geotextiles, geonets, and GCLs. Patches shall be cut with rounded corners. Patches shall be made as per the manufacturer's instructions and are subject to the Engineer's inspection and approval. Damaged sections shall be patched as outlined herein. When patching the GCL, granular bentonite shall be applied between the patch and liner, and two surfaces pressed together immediately. Any wrinkles shall be smoothed out.

The Contractor shall be responsible for constructing and backfilling all geosynthetic materials termination trenches in cooperation with the geosynthetic component installation contractor, as detailed on the Plans. The Contractor shall ensure that all geosynthetic materials termination trenches are free of any irregularities that may interfere with the installation of the materials. Trench backfill methods and materials shall be approved by the Engineer.

Upon completion of each component installation and prior to placement of the subsequent layer, the component shall be jointly inspected by the Engineer and the supplier's technical representative to determine the integrity of the field seams or other joining methods, as well as the general condition of the component. All joints on the completed work shall be tightly bonded.

## B. Cell Bottom

1. Compacted soil liner materials shall not be placed on the bottom of the OCF cell until the foundation preparation has been completed and the foundation has been inspected and approved by the Engineer. The foundation shall be scarified perpendicular to the slope of the foundation and loosened to a minimum depth of 2 inches. The moisture content of the loosened materials shall be controlled as specified for the compacted soil layer materials. The first lift of the compacted soil layer shall be placed continuously across the foundation, compacted and bonded with the foundation materials as specified for subsequent layers of compacted soil materials.

Placement and compaction of each lift shall be consistent with the procedures and equipment used in the test pad work.

Compaction of each lift shall be accomplished by using a sheepfoot roller.

2. Placement of the compacted soil materials shall be in lifts not to exceed 6" after compaction, discing and any moistening or aeration required to obtain proper compaction. Compaction of each lift shall be performed leaving the surface of the compacted lift in a scarified condition. Each lift shall be compacted to 95% of standard Proctor maximum dry density or greater if required by the results of the test pad fill. Field density and moisture content tests will be performed on each layer placed.

If, in the opinion of the Engineer, the prepared surface of any layer is too dry or smooth to bond properly with the next layer to be placed thereon, the surface shall be moistened and/or worked with a harrow, scarifier, or other suitable equipment, in an approved manner to a sufficient depth to provide a satisfactory bonding surface before the next succeeding layer of material is placed.

The moisture content during placement shall be between the optimum moisture content and 3 percent above the optimum moisture content or as required by the results of the test pad fill. Placement of overwet material will not be permitted. Work shall be shutdown in the event of precipitation, where in the opinion of the Engineer, an overwet condition could result. Shutdown procedures shall include rolling the entire surface with a smooth drum compactor or other approved equipment suitable to make a smooth dense surface capable of shedding runoff without pointing. Following shutdown, any previously compacted surface material which has become overly wet and softened or has been partially eroded shall either be removed and replaced or scarified, air dried and recompacted, as directed by the Engineer. In any event, the surface of the existing layer shall be scarified before placement of the next lift.



Soils which are drier than optimum shall be moistened by the addition of water and thorough blending to produce uniform moisture distribution prior to compaction.

All compacted low permeability soil surfaces shall be protected from drying to prevent cracking. This may be accomplished by temporarily covering the compacted surface or by watering as directed by the Engineer.

The final surface of the composite bottom, top, and low hydraulic conductivity layers shall be compacted and graded smooth to the elevations shown on the Plans. Upon approval of the final layer elevation, the final surface shall be hand raked, wetted if necessary, and rolled with a smooth drum roller to achieve a smooth uniform surface ready to receive the FML.

3. The Contractor shall cooperate with the Engineer and the geomembrane installation contractor to ensure the FML installation follows the compacted soil layer construction in a timely manner. This includes notifying the geomembrane installation contractor when the surfaces are ready for the FML installation.

If the Engineer deems the hydraulic integrity of the compacted soil layer has been adversely affected by a delay in the FML installation, the geomembrane contractor shall repair the prepared surface, at no cost to the Owner, in accordance with the Engineer's instructions. This may include scarifying and recompacting with the addition of water, as appropriate.

The FML shall be installed, seamed, tested, and protected in accordance with the manufacturer's and supplier's instructions and in accordance with Section 9-35.1(6) of these special provisions. In the event of conflict, the more stringent procedure shall apply unless approved otherwise by the Engineer and EPA.

4. Equipment will not be allowed to operate directly on the surface of the FML or other components of the liner system.

After the FML has been installed by the Contractor and approved by the Engineer, the nonwoven geotextile cushion fabric shall be placed on the FML. The cushion fabric shall meet the requirements of Section 9-33.1(1) of these special provisions.

Adjacent cushion fabric panels may be sewn or overlapped. For overlapped seams, the overlap distance shall be a minimum of 18 inches.

5. Placement of subsequent materials and equipment shall require the use of overhead crane systems. A pad shall be constructed on the appropriate liner to protect the underlying liner components, prior to placing equipment on the pad. The maximum height of drop of the pad materials shall be less than 3 feet from the surface of the liner. Drop heights very close to the liner components will not be allowed.

A small track dozer shall be used for spreading material over the liner components. Such equipment shall have a ground contact pressure that does not exceed 6 to 8 pounds per square inch. Materials shall be placed at the edge of the pad by the crane system in such a manner to allow straight-line movement along the cell bottom. To the extent possible, material shall be placed by the crane system on areas previously covered and the dozer shall be used to push the material over uncovered liner components. Only gradual turns will be allowed and equipment braking shall be minimized.

6. The Contractor shall place a 12" drainage layer over the cushion fabric in a single lift, taking extreme care to protect the FML and cushion fabric. Compaction shall consist of one pass with loaded haul equipment or a smooth drum roller.
7. After the drainage layer has been installed by the Contractor and approved by the Engineer, the drainage layer shall be overlain with a nonwoven geotextile separation fabric. The separation fabric shall meet the requirements of Section 9-33.1 of the Standard Specifications.

During the construction of the drainage layer, the leak detection, collection and removal system shall be installed as detailed on the Plans and in accordance with these special provisions.

Items 1 through 7 above describe the construction of the composite bottom liner. Construction of the composite top liner shall follow the same order of work as outlined in Items 2 through 7 above.

During construction of the drainage layer in the composite top liner, the leachate collection and removal system shall be installed as detailed on the Plans and in accordance with these special provisions. After installation of the leachate collection and removal system separation geotextile, a 12" thick layer of processed soil (see Section 2-03.3(9)C, Item 2 of these special provisions) shall be placed for protection. The height of placement for the operational layer shall be limited to 10'.

### C. Cell Side Slopes

On the side slopes of the cell, the composite bottom liner shall be constructed as outlined in **B. Cell Bottom** - Items 1 through 3 above. While installing the FML, two single pipe boots shall be installed as detailed on the Plans, at the locations staked in the field. The installation of the two riser pipes between the boots and Vault #1, will be performed concurrently with the pipe boot installation. After the FML has been installed by the Contractor and approved by the Engineer, the geocomposite drainage net shall be placed on the FML.

1. The drainage layer on the side slopes shall consist of the installation of the geocomposite drainage net with nonwoven geotextile material bonded to both sides.

The geocomposite drainage net shall meet the requirements of Section 9-33.1(2) of these special provisions.

Care shall be taken to keep the drainage net clean and free from debris prior to installation. If the drainage net is not clean before installation, it shall be washed by the Contractor just prior to installation.

Adjacent roll shall be overlapped no less than 3 inches, roll ends should be overlapped no less than 6 inches, and secured by plastic ties at least every five (5) feet along the roll length and at least every 6 inches along the roll ends and in the anchor trench. Plastic ties shall be white or other bright color for easy inspection. Metallic ties shall not be used.

In the corners of the side slopes, where overlaps between rolls are staggered, an extra layer of drainage net shall be installed from the top to the bottom of the slope.

The Contractor shall place subsequent liner components in such a manner to ensure that the drainage net and other underlying materials are not damaged in any way.

The installer shall handle the drainage net in such a manner as to ensure it is not damaged in any way. The geocomposite material shall be rolled down the side slope over the FML in such a manner as to continually keep the geocomposite in tension. If necessary, the drainage net shall be positioned by hand after being unrolled to minimize wrinkles. The geocomposite materials shall not be placed in the horizontal direction (i.e., across the slope).

Continuation of the installation of the LDCRS shall be performed concurrently with the geonet installation. The LDCRS riser pipe shall be connected to the single pipe boot as detailed on the Plans. The LDCRS shall be constructed as detailed on the Plans.

2. After the placement of the drainage layer has been approved by the Engineer, installation of the composite top liner may commence.

The Contractor shall install the geosynthetic clay liner (GCL) in accordance with the manufacturer's directions and in accordance with these special provisions. In the event of conflict, the more stringent procedure shall apply unless approved otherwise by the Engineer and EPA. The liner shall be placed on the side slopes in such a manner as to assure minimum handling. Dragging of the liner over the previously installed liner should be minimized. No lining material shall be placed when the air temperature is less than 40 degrees F, when the relative humidity is greater than 80%, when it is raining, when there is frost on the ground or when conditions may have a detrimental affect on the finished product.

On the side slopes, the GCL shall be anchored at the top and then unrolled so as to keep the material free of wrinkles. Seams shall be perpendicular to the toe of the slope at all times. No horizontal seams will be allowed on slopes. Seams at the base of the slope shall be a minimum of 5 feet away from the toe.

Seam areas or runs shall also be free of debris. Contacting surfaces shall be clean with all edges pulled tight to maximize contact and to smooth out any wrinkles or creases. Overlaps shall be a minimum of 12 inches and verified by the Installer. A proper seam will cover the six and nine inch lap lines.

Seams shall be augmented with granular bentonite to ensure seam integrity. Granular bentonite shall be dispersed evenly from the panel edge to the lap line at a minimum rate of 1/4 pound per lineal foot continuously along the seams or overlap areas. Accessory bentonite shall be of the same type as the material within the composite liner itself. Adhesives may be used on the seams to keep the panel in contact during the placement of the subsequent liner components if necessary.

The GCL shall be laid only over an area that can be completed (including installation of the FML) in one working day. Completion shall be defined as the full installation including anchoring of the liner and placement of the FML.

Upon completion of the GCL installation and prior to placement of the FML, the GCL shall be inspected by the Engineer to determine the integrity of the field seams (overlaps), as well as the general condition of the liner. All joints on completion of the work shall be tightly bonded. Any liner surface showing injury due to scuffing, penetration of foreign objects or other notable distress shall, as directed by the Engineer, be replaced or covered and sealed with an additional layer of GCL material.

All rips and tears shall be repaired by completely exposing the affected area, removing all foreign objects or debris, and then placing a patch over the damage, with a minimum overlap of 12 inches on all edges. Accessory bentonite shall be placed between the patch and the repaired material at a rate of 1/4 pound per lineal foot of edge over a six-inch width. The edges of the patch shall be fastened to the repaired liner with construction adhesive, in addition to the bentonite-enhanced seam.

3. The Contractor shall cooperate with the Engineer and the geomembrane installation contractor to ensure the FML installation follows the GCL installation in a timely manner. This includes notifying the geomembrane installation contractor when the surfaces are ready for the FML installation.

The FML shall be installed, seamed, tested, and protected in accordance with the manufacturer's and supplier's instructions (see Section 9-35.1(6) of these special provisions) and in accordance with these special provisions. In the event of conflict,

the more stringent procedure shall apply unless approved otherwise by the Engineer and EPA.

While installing the FML, one single pipe boot shall be installed as detailed on the Plans at the location previously denoted in the field. The boot shall be attached to the previously installed pipe leading to Vault #1 as detailed on the Plans.

4. Installation of the drainage layer shall be performed as outlined in **C. Cell Side Slopes** - Item 1 above.

Continuation of the installation of the LCRS shall be performed concurrently with the geonet installation. The LCRS riser pipe shall be connected to the double pipe boots as detailed on the Plans. The LCRS shall be constructed as detailed on the Plans.

5. After the placement of the drainage layer has been inspected and approved by the Engineer, backfilling of the cell may commence in accordance with Section 2-03.3(9) of these special provisions.

#### **D. Cell Cover**

1. After the cell has been backfilled with all minus 6" source area materials, a final cushion course of 1" minus materials shall be placed. The cushion course (cover system foundation) shall be a minimum of 3' thick, shaped to the line, grade, and cross-section shown on the Plans, and compacted to 95% of standard Proctor maximum dry density.

Compacted soil layer materials shall not be placed on the top of the OCF cell backfill until the cover system foundation preparation has been completed and the cover system foundation has been inspected and approved by the Engineer. The cover system foundation shall be scarified perpendicular to the slope of the cover system foundation and loosened to a minimum depth of 2 inches. The moisture content of the loosened materials shall be controlled as specified for the compacted soil layer materials. The first lift of the compacted soil layer shall be placed continuously across the cover system foundation, compacted and bonded with the cover system foundation materials as specified for previous layers of compacted soil materials.

Compaction of each lift shall be accomplished by using a sheepfoot roller.

2. Placement of the 2' thick compacted soil layer shall be performed as outlined in **B. Cell Bottom** - Item 2 above.
3. Placement of the 40-mil textured HDPE FML and the nonwoven geotextile cushion fabric shall be performed as outlined in **B. Cell Bottom** - Items 3 and 4 above.

4. Placement of the 12" drainage (biotic) layer and the nonwoven geotextile separation fabric shall be performed as outlined in **B. Cell Bottom** - Items 6 and 7 above. Placement of the cover system subsurface drainage facilities in the drainage layer, shall also be performed to the grades and lines shown on the Plans and as staked by the Engineer.
5. The top cover material for the cover system shall be Topsoil Type C. Placement of the topsoil shall be performed as outlined in Section 8-01 of the Standard Specifications.

#### **8-30.4 Warranty**

The installer of each geosynthetic component shall warrant his workmanship to be free of defects for two (2) years after the completion and acceptance of the work. This warranty shall include, but not be limited to, all seams, anchor trenches, and patches. The installer shall provide all warranty work and associated costs required by the Owner at no expense to the Owner. The installer shall also obtain and furnish the Owner a warranty from the component manufacturer for the materials used. The materials warranty shall be for defects or failure of the materials due to weathering for ten (10) years after the completion of the work on a prorata basis. All defects or failure of the material due to weathering shall be repaired at the Installer's sole expense.

#### **8-30.5 Measurement**

Measurement of each geosynthetic component installed will be made by the square yard of the surface area covered and accepted. The surface area covered is defined as the true area of all surfaces covered plus the designed burial in the anchor trenches. Materials required for overlaps will not be measured.

Measurement of the compacted soil layers, drainage materials, and cover soil will be made by the cubic yard, in place, determined by the neat lines required by the Plans.

#### **8-30.6 Payment**

The unit price per square yard for each of the specified geosynthetic components shall be full compensation for materials, labor, equipment, tools, and incidentals necessary to complete the work as specified. Such payment shall include work necessary to repair any damaged surfaces prior to the Engineer's acceptance.

The unit price per cubic yard for compacted soil layer, drainage material, and cover soil shall be full compensation for materials, labor equipment tools, and incidentals necessary to complete as specified. Such payment shall include payment of any royalties for materials and all costs of producing the required soil mix that results in the specified low-permeability compacted layer, in place.

**8-31 TEMPORARY CELL COVER** - Add the following new section:**8-31.1 Description**

A 20-mil polyvinyl chloride (PVC) liner will be used as a temporary cell cover. The temporary cell cover will be installed after the permanent liner system has been placed. The temporary liner can be anchored at the top of the berm in the permanent liner anchor trench. The temporary liner covering shall be installed after completion of the construction of the OCF for the season and shall be in place before the fall rain season begins.

The Contractor shall maintain the cover tightly in place by using the liner ballast windsocks. All seams and laps shall be as presented in Special Provisions, Section 9-35.2 Polyvinyl Chloride (PVC) Geomembrane. The Contractor shall be responsible to immediately repair all damaged areas. Cost for repair and maintenance shall be included in the unit contract price.

The temporary liner will be used during the winter months after construction activities have been completed. During the first winter the liner shall be constructed to minimize the ponding of precipitation within the constructed cell. Water collected on the liner will flow to the low point of the cell, where it will be pumped out to the on-site storm water system. During the second winter the liner shall be installed to prevent precipitation from being introduced to the constructed leachate collection system. Again, the water will flow to the low point within the cell where it will be pumped out to the storm water system.

No filling of the OCF is anticipated between the January 1 and May 31 period. If a very dry spring is experienced, filling may be considered after April 15 provided the extended 30 day forecast is predicting less than 40% chance of precipitation.

**8-31.2 Materials**

The material shall meet the requirements of Section 9-35.2 of these special provisions.

**8-31.3 Construction Requirements**

The liner system shall be installed and removed in such a manner that it can be reused with a minimum amount of damage or waste. The bottom portion shall be installed first, and overlapping this portion with the side panels. The bottom panels shall be installed up the side slopes a minimum of 6 feet from the floor elevation of the cell.

Adjacent panels shall be overlapped and flat rolled a minimum of 3 times prior to the placement of sandbags. On the bottom, the overlap shall be accomplished by folding the higher (uphill) panel back 18" and covering this fold with the lower panel. The flat roll

shall then proceed downhill as detailed on the Plans. On the sideslopes, the adjacent panels shall also be overlapped and flat rolled as specified for the bottom panels. Edges of the panels along the top of the cell shall be anchored in a temporary cutoff trench.

Sandbags shall be placed on the flat rolls at a minimum spacing of 6'. Sandbags placed on the side slopes shall be tied to a tether that runs up the entire length of the slope and is adequately secured along the top of the slope. Sandbags will not be required, after the liner installation, on any run that will be covered with a windsock.

During the backfilling of the cell, the cover on the bottom of the cell will be removed, saved, and replaced as necessary. Cover panels and the windsocks on the side slopes shall be rolled up as the backfilling operations proceed. Panels and windsocks may be cut and disposed of, provided the remaining components still maintain the cover required to protect the side slopes and to minimize the generation of leachate.

No part of the temporary cell cover or windsock will be allowed to remain as a component of the final liner system.

#### **8-31.4 Measurement**

Temporary cell cover will be measured by the square yard of the surface area covered and accepted. Materials required for overlaps will not be measured.

#### **8-31.5 Payment**

The unit price per square yard for temporary cell cover shall be full compensation for materials, labor, equipment, tools, and incidentals necessary to complete the work as specified. Payment for sandbags shall be covered under the unit price per square yard for installed temporary cell cover. Such payment shall include work necessary to repair any damaged surfaces prior to the Engineer's acceptance.

### **8-32 OCF LEACHATE COLLECTION SYSTEMS - Add the following new section:**

#### **8-32.1 Description**

This work consists of installing leachate collection systems and sumps in the composite bottom and top liners of the cell, as shown and detailed on the Plans. Included in this work is the installation of the vaults, pumps, compressor, storage tank for the collected leachate, and the necessary electrical equipment, controls, alarms, and telemetry devices.

The work also includes the installation, operation, maintenance, and removal of temporary leachate collection system during the cell backfilling operations. During this time, leachate will be collected from the cell and pumped to the leachate collection tank



in Vault #2. The temporary system will remove the leachate from the tank and pipe it to the evaporation system as shown on the Plans.

### 8-32.2 Materials

Materials shall meet the requirements of the following sections:

Aggregates	9-03.1(3)C	(SS)
HDPE Casing and Conduit Pipe	9-05.21	(SP)
Pumping Equipment	9-36.1	(SP)
Compressor	9-36.2	(SP)
Precast Concrete Access Box	9-36.3	(SP)
Precast Concrete Vault	9-36.3	(SP)
Leachate Storage Tank	9-36.4	(SP)
Miscellaneous Leachate Collection Equipment	9-36.5	(SP)
Electrical	9-40 through 9-44	(SP)

The casing pipe shall be nominally 6" and 10" diameter HDPE pipe where shown on the Plans, with SDR of 17. Joining method shall be butt fusion method.

The piping conduit from the submersible pump installed in the casing pipe shall be a nominal 2" diameter HDPE pipe. Joining method shall be butt fusion method.

The temporary pipe between Vault #2 and the evaporation system shall be nominally 2" diameter HDPE pipe. Joining method shall be butt fusion method.

### 8-32.3 Scheduling

The Contractor shall construct and test all components of the leachate collection system, including the temporary system, prior to inspection and acceptance of same by the Engineer. Placement of the cell backfill materials will not take place until the collection systems have been tested and approved by the Engineer.

### 8-32.4 Construction Requirements

Precast concrete facilities shall be installed as detailed on the Plans. Casing pipes shall be installed in the trenches to the lines, grades and elevations shown on the Plans and backfilled as outlined in Section 7-01 of the Standard Specifications.

Materials excavated for the casing pipe installation will be hauled and stockpiled on-site as directed by the Engineer.

Install liquid measuring devices to proper elevations. Set pumps and connecting PVC piping that allows free movement within outer casing pipe.

Set internal liquid sensor float to activate the pumps when the liquid level reaches an elevation of 9 inches above the bottom of the drainage layer. Set lower stop to shut pump off when 1 inch or less of leachate remains on the bottom of the drainage layer.

The telemetry system shall be installed to alert the Owner when the leachate level in the tank reaches the 3/4 full capacity (750 gallons) and to deactivate the pump when the liquid level in the tank reaches 95% full. The Owner will designate the facility within the Town of Ruston where the receiver module is to be installed.

The Contractor shall conduct initial startup of the equipment and perform necessary operational checks. The Contractor shall provide a written statement that all equipment has been installed properly, started up and is ready for operation and inspection by the Engineer. The Contractor shall also instruct the Owner's personnel at the jobsite on the operation and maintenance of each system.

#### **8-32.5 Measurement**

The casing pipe will be measured by the linear feet of completed installation along the invert. Pipe placed in excess of the length designated by the Engineer will not be measured or paid for.

Gravel backfill for the leachate trench will be measured by the volume placed within the neat line limits of the structure excavation Class B.

The length of each leachate collection system will be the number of lineal feet of completed installation measured along the invert of the pumping conduit, and will include the length of the pipe through elbows, tees, and fittings. The number of lineal feet will be measured from the end of the pump through the access vault to the exterior wall of the precast concrete vault containing the storage tank.

No specific unit of measurement will apply for the lump sum items of furnishing and installing the precast concrete vaults.

No measurement will be made for pumps, compressor, and leachate storage tank.

No measurement will be made for the electrical equipment, controls, alarms, and telemetry devices.

#### **8-32.6 Payment**

Payment will be made for "HDPE Casing Pipe \_\_\_\_ In. Diam.", per foot.

Payment will be made for "Gravel Backfill for Casing Pipe", per cubic yard. Such payment shall include costs of installing filter fabric that encapsulates the gravel backfill in the trench.

Payment will be made for each "Leachate Collection Pumping System", per lineal foot. The unit contract price per lineal foot for the leachate collection system shall be full payment for all work to complete the work, including pump, liquid level controls, piping and fittings, pump testing, and providing O&M procedure instructions to the Owner's representative.

The lump sum contract price for "Vault #1" and "Vault #2" shall be full payment for all labor, materials, and equipment necessary to complete the work as shown on the Plans and as directed by the Engineer. Costs for furnishing the required ventilation equipment, the compressor in Vault #1, and the 1000-gallon storage tank in Vault #2 shall also be included in the respective lump sum price for the vaults.

The lump sum contract price for "Miscellaneous Leachate Collection Equipment" shall be full payment for all labor, materials, tools, equipment necessary to complete the work as outlined. The lump sum price shall include installing all necessary materials and equipment resulting in a fully operational leachate collection system.

### **8-33 OCF CAP SUBSURFACE DRAINAGE SYSTEM - Add the following new section:**

#### **8-33.1 Description**

This work shall consist of installing a subsurface drainage system in the drainage (biotic) layer of the cell cover system and a storm drain collection system, as shown and detailed on the Plans. Included in this work is the installation of cleanouts, manholes, perimeter road surface drain inlets, and the storm drain connection to the outfall system.

#### **8-33.2 Materials**

Materials shall meet the requirements of the following:

Aggregates	9-03.1(3)C	(SS)
Perforated Corrugated PE Under-drain Pipe	9-05.2(7)	(SS)
Corrugated PE Drain Pipe	9-05.1(6) & 9-05.1(7)	(SS)
Precast Concrete Manhole	9-12.4	(SS)
Pathway Drain Inlet	7-05	(SP)
Cleanouts		

#### **8-33.3 Construction Requirements**

### **8-33.3(1) Storm Drain Collection System**

The location of the storm drain collector system and the manholes will be determined by the Engineer in the field. The storm drain collector system will be connected to the outfall system that is described in PA 6.0, Group 2, Surface Water Drainage and Control. The OCF cap surface drain inlets will also be connected to the storm drain collection system.

A trench of the dimensions shown on the Plans shall be excavated to grade and lines given by the Engineer. Drain pipe shall be laid in conformity with the lines and grades shown on the Plans. The drain pipe shall be laid with watertight joints

Gravel backfill shall be used under the pipe. Gravel backfill shall be placed to the depth shown on the Plans or as directed by the Engineer. All backfill shall be in 12-inch maximum layers and be thoroughly compacted with three passes of a vibratory compactor for each layer.

### **8-33.3(2) Perimeter Trench System**

The location of the perimeter trench system will be determined by the Engineer in the field. Cleanouts shall be installed at the starting points of the perimeter drain.

The perforated pipe shall be placed in the bottom of the perimeter trench above the FML liner and backfilled with granular drainage material.

All perforated pipe shall be laid with the perforations down. Upon final acceptance of the system, all pipes shall be open, clean, and free draining.

PE drainage pipe shall be jointed with snap-on, screw-on, or wraparound coupling bands, as recommended by the pipe manufacturer.

### **8-33.4 Measurement**

The length of drain pipe or underdrain pipe will be the number of linear feet of completed installation measured along the invert. Pipe placed in excess of the length designated by the Engineer will not be measured or paid for.

Manholes will be measured per each. In addition to the measurement per each, manholes in excess of 10 feet in height will be measured per lineal foot for each additional foot over 10 feet. Measurement of manhole heights for payment purposes will be the distance from the flow line of the outlet pipe to the top of the manhole ring measured to the nearest foot.

Pathway drain inlets and cleanouts will be measured, per each.

Excavation of the pipe trench will be measured as structure excavation Class B by the cubic yard as specified in Section 2-09 of the Standard Specifications.

Gravel backfill for the perimeter drain and storm drain pipe will be measured by the volume placed within the neatline limits of the structure excavation.

### 8-33.5 Payment

Payment will be made in accordance with Section 1-04.1 of the Standard Specifications, for each of the following bid items that are included in the proposal:

"Storm Drain Pipe \_\_\_\_ In. Diam.", per linear foot.

"Underdrain Pipe \_\_\_\_ In. Diam.", per linear foot.

"Manhole \_\_\_\_ In. Diam. Type \_\_\_\_", per each.

"Manhole Additional Height \_\_\_\_ In. Diam. Type \_\_\_\_", per linear foot.

"Cleanout", per each.

"Pathway Drain Inlet", per each

"Gravel Backfill for Perimeter Drain/Storm Drain", per cubic yard.

"Structure Excavation Class B", per cubic yard.

### 8-34 OCF CELL SLOPE COVER - Add the following new section:

This work shall consist of installing erosion control matting on the outside slopes of the OCF cell in accordance with these special provisions and as detailed on the Plans and in conformity with the lines and dimensions established by the Engineer.

#### 8-34.1 Materials

Materials shall meet the requirements of the following sections:

Erosion Control Matting	9-14.5(4)	(SP)
Seed	9-14.2	(SP)
Fertilizer	9-14.3	(SP)
Mulch and Amendments	9-14.4	(SP)

#### 8-34.2 Construction Requirements

All surfaces to be treated shall be compacted as required elsewhere in these Specifications, shaped to the specified finished grades, and shall be free of undesirable weed or plant growth and all clods, rocks, and debris 3 inches or larger in any dimension.

The erosion control matting shall be installed in accordance with the manufacturer's instructions. Panels will be anchored at the top of the slope and shall be rolled down the slope. The bottom of the panel shall be incorporated as part of any surface water control

system required around the base of the slope. The bottom (outside) edge of the panels shall be terminated in accordance with the manufacturer's instructions.

Panels shall be anchored in a minimum 12 inch deep trench at the top of the slope around the entire perimeter. Adjacent panels shall be installed snugly with a 4 inch overlap and staked in place as detailed on the Plans.

After the erosion control matting has been installed and accepted by the Engineer, seeding, fertilizing, and mulching operations shall be performed as specified in Section 8-01 of the Standard Specifications and Section 8-01 of these special provisions.

#### **8-34.3 Measurement**

Measurement of the erosion control matting will be by the square yard of surface area covered and accepted in accordance with these special provisions and the Plans. Required panel overlaps will not be measured for payment.

Measurement for seeding, fertilizing, and mulching will be as outlined in Section 8-01.4 of these special provisions.

#### **8-34.4 Payment**

The unit price per square yard for "Erosion Control Matting" shall be full pay to install erosion control matting and to maintain the matting throughout the erosion control period.

Payment for seeding, fertilizing, and mulching will be as outlined in Section 8-01.5 of these special provisions.

### **8-35 LINER BALLAST WINDSOCK - Add the following new section:**

This work shall consist of furnishing, filling, and installing liner ballast windsocks over the liner components to prevent wind uplift until the cell is backfilled, in accordance with these special provisions and as detailed on the Plans.

#### **8-35.1 Materials**

The windsock tubing shall consist of used fire hose, Goodyear Spiraflex® Blue, 5 or 6-inch diameter water discharge hose, or other approved tubing. The tubing shall have a cross-sectional area of at least 0.136 square feet (5-inch diameter). The moist sand mixture inside the tube shall provide a ballast weight of at least 15.6 pounds per foot.

The sandbags shall consist of a reinforced polyethylene bag, when filled with a coarse sand and gravel, weighs approximately 90 to 125 pounds. The open end of the bag shall be closed and tied with a nylon or poly cord.

The fill material to be placed in the tubing and sandbags shall consist of a mixture of sand and gravel having a loose unit weight of approximately 115 pounds per cubic foot. Processed source area soils may be used upon approval of the Engineer.

#### **8-35.2 Construction Requirements**

The windsock shall extend from the anchor trench at the top of the cell down to the toe of the slope. The maximum slope length is approximately 200 feet.

The tubing shall be completely filled using a grout or concrete pump capable of pumping a moist sand mixture and anchored in the liner system anchor trench. The bottom of the windsock shall be secured with a minimum of two sandbags as detailed on the Plans.

#### **8-35.3 Measurement and Payment**

Measurement will be made by the number of windsocks installed, per each.

Payment will be made for "Liner Ballast Windsock", per each. Such price shall be full compensation for furnishing all materials, labor, tools, equipment, and other incidental work necessary to complete the work.

### **8-36 REINFORCED CHANNEL LINING - Add the following new section:**

This work shall consist of installing reinforced channel lining in erosion control ditches in accordance with these special provisions and as detailed on the Plans and in conformity with the lines and dimensions established by the Engineer.

#### **8-36.1 Materials**

Materials shall meet the requirements of the following sections:

Reinforced Channel Lining	9-14.5(5)	(SP)
Seed	9-14.2	(SP)
Fertilizer	9-14.3	(SP)

#### **8-36.2 Construction Requirements**

All ditch surfaces to be treated, shall be shaped to the specified finished grades and cross-section and finished to a smooth and even condition, and shall be free of undesirable weed or plant growth and all clods, rocks, and debris 3 inches or larger in any dimension. The top 1/2 to 1 inch of soil surface shall be loosened to accommodate seed and lining bedding. Seed and fertilizer shall be applied prior to placement of the lining.

The reinforced channel lining shall be installed in accordance with the manufacturer's instructions. Panels will be anchored at the top of the ditch slope in a minimum 6 inch deep by 6 inch wide trench and stapled. Lining shall be rolled down the channel. The bottom of the panel shall be incorporated as part of any surface water control system required around the base of the slope. The outside edge of the panels shall be terminated in a minimum 6 inch deep by 6 inch wide trench and stapled.

Adjacent panels shall be installed end over end (shingle style) with a 6 inch overlap and stapled in a double row of staggered staples 4 inches apart.

### **8-36.3 Measurement**

Measurement of the reinforced channel lining will be by the square yard of surface area covered and accepted in accordance with these special provisions and the Plans. Required lining overlaps will not be measured for payment.

Measurement for seeding and fertilizing will be as outlined in Section 8-01.4 of these special provisions.

### **8-36.4 Payment**

The unit price per square yard for "Reinforced Channel Lining" shall be full pay to provide and install erosion control channel lining.

Payment for seeding and fertilizing will be made as outlined in Section 8-01.5 of these special provisions.

## **8-37 PRECAST CONCRETE BLOCKS - Add the following new section:**

### **8-37.1 Description**

The work consists of furnishing and installing precast concrete blocks along the outside shoulder of the temporary construction access road as shown on the Plans or as directed by the Engineer.

### **8-37.2 Materials**

The precast concrete blocks shall be nominal 2'x 2'x 6', with lifting loops, as manufactured by Lone Star Northwest, Tacoma, Washington, or an approved equal.

### **8-37.3 Construction Requirements**

The blocks shall be placed with a maximum 5 foot separation.



### 8-37.4 Measurement and Payment

Measurement will be made by the number of 2' x 2' x 6' blocks, per each, in place.

Payment will be made for "Precast Concrete Block", per each. Such price shall be full compensation for furnishing all materials, labor, tools, equipment, and other incidental work necessary to complete the work.

### 8-38 CONSTRUCT ACCESS ROAD INTO CELL - Add the following:

#### 8-38.1 Description

The work consists of furnishing, filling, and installing polypropylene duffel top bags in the construction of the temporary construction access road into the OCF cell as shown on the Plans or as directed by the Engineer.

The work also includes furnishing and installing geogrids as shown on the Plans or as directed by the Engineer.

#### 8-38.2 Materials

Materials shall meet the requirement of the following:

Supersacks	9-38	(SP)
Geogrids	9-39	(SP)
Processed Surface Course	5-06.2	(SP)

#### 8-38.3 Construction Requirements

The supersacks shall be completely filled with processed source area soils or other materials approved by the Engineer. The top of the bag shall be closed and tied off in accordance with the manufacturer's instructions.

Placement of the bags shall require the use of overhead crane systems. Bags shall be initially placed within the bottom of the cell, snugly against previously placed bags and proceeding up the slope of the cell as directed by the Engineer.

After all bags have been installed within the noted limits, placement of additional source area soils and the geogrids shall begin. Placement of the 6 inch lift between the bags and the geogrids shall start at the bottom of the road and proceed upward. This material shall be placed with overhead crane systems. No equipment will be allowed to come in direct contact with the bags.

After the geogrids have been installed in accordance with the manufacturer's instructions, the construction of the remaining roadway prism, and the placement of the

surfacing course and precast concrete blocks can take place. The remaining roadway prism material shall be placed starting at the bottom and proceed up the slope.

The access road into the cell shall remain in place during the backfilling of the cell. The precast concrete blocks shall be removed from the road as backfilling operations proceed.

#### **8-38.4 Measurement**

Supersacks will be measured, per each, in place.

The geogrid will be measured by the square yard of material placed and accepted within the limits shown.

#### **8-38.5 Payment**

Payment will be made for "Supersack", per each. Such price shall be full compensation for furnishing all materials, labors, tools, equipment, and other incidental work necessary to complete the work.

The price per square yard for "Geogrid" shall be full pay to furnish and install geogrids.

### **8-39 SEDIMENT BASIN #2 - Add the following new Section:**

#### **8-39.1 Description**

This work consists of construction a sediment basin as shown and detailed on the Plans. Included in this work is the construction of a soil berm and installation of sediment basin appurtenances and geomembrane liner.

Material for the soil berm will be furnished by the Owner from a stockpile identified by the Engineer. The Contractor shall furnish and install all other components of the sediment basin.

#### **8-39.2 Materials**

Materials shall meet the requirements of the following Sections:

HDPE Pipe	9-05.21	(SP)
PVC Geomembrane Liner	9-35.2	(SP)
Cushion Geotextile	9-33	(SP)
Pre-cast Concrete Manhole	9-12.4	(SS)

#### **8-39.3 Construction Requirements**

**8-39.3(1) Site Preparation**

The subgrade shall be prepared in accordance with Section 9-35.2(6)A of the Special Provisions. The subgrade shall be inspected and approved by the Engineer prior to berm construction and prior to liner placement.

**8-39.3(2) Berm Construction**

The berm shall be constructed to the lines and grades as indicated on the Plans. Soil materials, from an on-site stock pile, shall be placed and compacted in accordance with Method A of Section 2-03.3(14) of the Standard Specifications.

**8-39.3(3) Liner Installation**

The 16 oz. geotextile shall be installed to the limits shown on the plans as follows:

1. The geotextile shall be handled in a manner to ensure that it is not damaged.
2. The geotextile shall extend to the toe of the outside berm slope and be anchored, along with the geomembrane liner, with a soil berm.
3. In the presence of wind, the geotextile shall be weighted with sand bags or equivalent.
4. The geotextile shall be cut using an approved cutter. If the material is being cut in place, special care must be taken to protect other geosynthetic materials from damage.
5. Seams shall be overlapped at least 12 inches.

The geomembrane liner shall be installed in accordance with Section 9-35.2(6) of the Special Provisions.

**8-39.4 Measurement and Payment**

This work shall will not be measured for payment. The lump sum contract price for "Sediment Basin #2" shall be full pay for load, haul, and placement of berg material, and, furnishing and installing geotextile and geomembrane liners and basin appurtenances .

## **DIVISION 9**

### **MATERIALS**

#### **9-05 DRAINAGE STRUCTURES, CULVERTS, AND CONDUITS**

**9-05.21 High Density Polyethylene (HDPE) Pipe** - Add the following new section:

##### **9-05.21(1) Acceptable Manufacturers**

1. High Density Polyethylene (HDPE) pipe and appurtenances shall be: Driscopipe 1000 as manufactured by Phillips Driscopipe, Inc., P. O. Box 83-3866, 2929 North Central Expressway, Suite 300, Richardson, TX 75083, Telephone 1-800-527-0662; or approved equal.
2. Any HDPE pipe manufacturer who produces PE pipe and fittings in compliance with this special provision shall submit its data sheet, test designations, and the test results, to the Engineer for review and evaluation. Consideration of the documentation will be used to approve the material for inclusion in the work.
3. Pipe and fittings shall be of the size and lengths shown on the Plans.
4. Slots in the pipe shall be as shown on the Plans.

##### **9-05.21(2) Description of Materials**

The pipe shall be a PE 3048 high density, high extra molecular weight polyethylene piping system meeting the physical properties and pipe performance requirements listed in Table 9-05-1. It shall be specified by ASTM D-3350 as having a cell classification of PE345434C. Dimensions and workmanship are specified by ASTM F-714. HDPE pipe shall have a SDR of 17.

##### **9-05.21(3) Pipe Extrusion**

The pipe shall be extruded using a melt homogenizing/plasticating extruder and "appropriate" die. The extruder screw design should be customized for the HDPE being processed to minimize melt fracture of the molecular structure thus reducing the molecular weight and changing some physical properties from resin to pipe. The resin should be processed at its melt temperature of 375°F to 425°F. The extruded tubular melt will be vacuum or pressure sized in downstream cooling tanks to form round pipe to specification diameter and wall thickness with a "matte-finish" surface.

TABLE 9-05-1 TYPICAL PHYSICAL PROPERTIES\*

Property	Specification	Units	Nominal Values
Material Designation	PPI/ASTM	-	PE 3408
Material Classification	ASTM D-3350	-	III C 5 P34
Cell Classification	ASTM D-3350	0	345434C
Density (3)	ASTM D-1505	gm/cm <sup>3</sup>	0.955 max.
Melt Flow (4)	ASTM D-1238	gm/10 min.	<0.15
Flex Modulus (5)	ASTM D-790	Psi	110,000 to 160,000
Tensile Stress.(4)	ASTM D-638	Psi	3000 to 3500
ESCR (3)	ASTM D-1693	F <sub>o</sub> , Hr.	F <sub>o</sub> > 5000
HDB @ 73°F (4)	ASTM D-2837	Psi	1600
U-V Stabilizer (C)	ASTM D-1603	%C	≥2
Hardness	ASTM D-2240	Shore "D"	65
Tensile Strength @ Yield (Type IV Spec.)	ASTM D-638 (2"/min.)	Psi	3200
Tensile Strength @ Break (Type IV Spec.)	ASTM D-638	Psi	5000
Elongation @ Break	ASTM D-638	%, minimum	750
Modulus of Elasticity	ASTM D-638	Psi	130,000
ESCR:			
(Cond A, B, C: Mold. Slab)	ASTM D-1693	F <sub>o</sub> , Hr.	F <sub>o</sub> > 5000**
(Compressed Ring (Pipe))	ASTM F-1248	F <sub>o</sub> , Hr.	F <sub>o</sub> > 3500
Impact Strength (IZOD) (.125" THK)	ASTM D-256 (Method A)	In-lb/in Notch	42
Linear Thermal Expansion Coefficient.	ASTM D-696	in/in/°F	1.2 X 10 <sup>-4</sup>
Thermal Conductivity	ASTM C-177	BTU-in/ Ft <sup>2</sup> /hr./°F	2.7
Brittleness Temp.	ASTM D-746	°F	<-180°F
Vicat Soft. Temp.	ASTM D-1525	°F	+257
Heat Fusion Cond.	-	psi @ °F	75 @ 400 °F
NSF Listing	Standard #14	-	"Listed"

\* This list of Typical Physical Properties is intended for basic characterization of the pipe.

\*\* Tests were discontinued because no failures and no indication of stress crack initiation.

### 9-05.21(4) Pipe and Fittings

#### 9-05.21(4)1 Pipe:

1. The pipe and fittings supplied under this specification shall be of the diameter, Standard Dimension Ratio (SDR) , and nominal psi rated, as shown on the Plans.
2. The pipe shall be inspected per industry accepted manufacturer standards for:

#### a) Diameter

- b) Wall Thickness
  - c) Concentricity
  - d) Quick Burst Pressure and Ductility
  - e) Joint Length
  - f) Straightness
  - g) Quality
  - h) Toe-In
  - i) Overall Workmanship Inspection on ID & OD
  - j) Print Line
3. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogenous throughout and free of visible cracks, holes, voids, foreign inclusions, or other deleterious defects, and shall be identical in color, density, melt index and other physical properties throughout.
4. Pipe Performance - The pipe shall be in compliance with the physical and performance requirements of Typical Physical Properties of this specification. Specifically, the pipe will be extruded from resin meeting specifications of ASTM D-3350 with a cell classification of PE:345434C; and ASTM D-1248 pipe grade resin type III, Class C, Category 5, grade P34 polyethylene compound. The pipe shall exhibit the short term tensile and compressive physical properties listed in Typical Physical Properties. The pipe shall provide the long term endurance characteristics recognized by: the compressed pipe ring environmental stress crack resistance greater than 1000 hours; the slow crack growth resistance greater than 32 days; and the impact strength (toughness) greater than 42 inch-pound/inch notch.

#### **9-05.21(4)2 Fittings:**

The standard HDPE fittings shall be standard commercial products manufactured by injection molding or by extrusion and machining, or, shall be fabricated from PE pipe conforming to this specification. The fittings shall be fully pressure rated by the manufacturer to provide a working pressure equal to the pipe for 50 years service at 73.4°F with an included 2:1 safety factor. The fittings shall be manufactured from the same resin type, grade, and cell classification as the pipe itself. The manufacture of the fittings shall be in accordance with good commercial practice to provide fittings homogeneous throughout and free from cracks, holes, foreign inclusions, voids, or other injurious defects. The fitting shall be as uniform as commercially practicable in color, opacity, density and other physical properties. The minimum "quick-burst" strength of the fittings shall not be less than that of the pipe with which the fitting is to be used.

#### **9-05.21(5) Construction Requirements**

Construction and installation shall be performed in compliance with the manufacturer's System Design Guidelines and System Installation Guidelines, and this special

provision. In the event of conflict, the more stringent procedure shall apply unless approved otherwise by the Engineer and EPA.

**9-05.21(5)1 Joining:**

1. Sections of polyethylene pipe shall be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict conformance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures shall be capable of meeting all conditions recommended by the pipe manufacturer, including but not limited to, temperature requirements of 400 OF, alignment, and 75 psi interfacial fusion pressure.
2. Butt fusion shall be 100% efficient offering a joint weld strength equal to or greater than the tensile strength of the pipe. Socket fusion shall not be used. Extrusion welding or hot gas welding of HDPE shall not be used for pressure pipe applications nor in fabrications where shear or structural strength is important.

**9-05.21(5)2 Pipe Placement:**

1. The pipe shall be placed in the trench in a "snaked" fashion to allow for possible longitudinal expansion and contraction, and shall be allowed to equalize with the ground temperature as much as practical before placing backfill.
2. Bedding for the pipe shall support the pipe uniformly throughout its length and the cradle must be shaped to conform to the outside of the pipe. It is anticipated that the construction of the cradle will require hand tools and manual labor.
3. No pipe shall be laid until the foundation has been approved by the Engineer. All pipe laid without prior approval shall be removed and relaid on an approved foundation at no additional cost to the Owner.

**9-05.22 - Geocomposite Slope Drain - Add the following new section:**

**9-05.22(1) Acceptable Manufacturers**

1. Geocomposite drains and fittings shall be: AdvanEDGE pipe as manufactured by Advanced Drainage Systems, Inc., 3300 Riverside Drive, Columbus, OH 43221, Telephone 1-800-821-6710; or approved equal.
2. Any pipe manufacturer who produces pipe and fittings in compliance with this special provision shall submit its data sheet, test designations, and the test results, to the Engineer for review and evaluation. Consideration of the documentation will be used to approve the material for inclusion in the work.

3. Pipe and fittings shall be of the size and lengths shown on the Plans.

#### 9-05.22(2) Description of Materials

The geocomposite drain shall consist of a panel, a minimum of 12 inches wide, with a thickness adequate to meet the specified flow capacity. The panels shall be available in roll lengths to accommodate the maximum project slope lengths without fittings, and containing a non-collapsible waterway for unrestricted flow.

The core material shall be made of polyethylene, polystyrene, or other polymeric material that maintains the required flow under specific loads.

The water inlet area shall be a minimum of 5 square inches open area to the core per lineal foot of drain.

The flow capacity, as determined by ASTM D-4716, shall be 0.736 gallons per minute per foot of width under normal load of 10,000 pounds per square foot and a gradient of 0.1 foot per foot.

The geotextile wrap around the core shall meet or exceed the following:

1. Fabric Weight (ASTM D-5216) - 7.1 ounces per square yard
2. Grab Tensile Strength (ASTM D-4632) - 205 pounds
3. Grab Tensile Elongation (ASTM D-4632) - 50 percent
4. Puncture Resistance (ASTM D-4833) - 95 pounds
5. Permittivity (ASTM D-4491) - 95 gallons per minute per square foot
6. Apparent Opening Size (AOS) (ASTM D-4751) - 100 sieve size

### 9-13 RIPRAP, QUARRY SPALLS, SLOPE PROTECTION, AND ROCK WALLS

#### 9-13.6 Quarry Spalls - Delete and replace with the following:

The stone shall be hard, sound, and durable. It shall be free from segregation, seams, cracks, and other defects tending to destroy its resistance to weather.

Quarry spalls shall meet the following requirements for grading:

<u>Sieve Size</u>	<u>Percent Passing</u>
8"	100
3"	40 max.
¾"	10 max.

### 9-14 EROSION CONTROL AND ROADSIDE PLANTING

#### 9-14.2 Seed - Add the following:



Seed for all slopes shall be grass seed of the following composition, proportion and quality, applied at the rate of 80 pounds per acre on all areas requiring seeding within the project:

<u>Kind and Variety of Seed in Mixture</u>	<u>% by Weight</u>	<u>Minimum % Pure Seed</u>	<u>Minimum % Germination</u>
Chewing Fescue	40	39.20	90
Colonial Bentgrass			
Var. Astoria	10	9.80	85
Perennial Rye	40	39.20	90
White Dutch Clover			
Preinoculated	10	9.80	90
Weed Seed		0.50 max.	
Inert and Other Crop		1.50 max.	
<b>TOTAL</b>		<b>100%</b>	

**9-14.3 Fertilizer - Add the following:**

The Contractor shall apply sufficient quantities of fertilizer to supply the following amounts of nutrients:

Total Nitrogen as N - 135 pounds per acre.

Available Phosphoric Acid as  $P_2O_5$  - 60 pounds per acre.

Soluble Potash as  $K_2O$  - 60 pounds per acre.

Ninety five (95) pounds of nitrogen applied per acre shall be derived from ureaform or ureaformaldehyde. The remainder may be derived from any source.

The fertilizer formulation and application rate shall be approved by the Engineer before use.

**9-14.4(2) Wood Cellulose Fiber - Add the following:**

**Mulch**

Mulch shall be a bonded fiber matrix, such as Soil Guard, manufactured by Weyerhaeuser Engineered Fiber Products, 7001 396<sup>th</sup> SE, Snoqualmie, WA 98065, Telephone 1-800-704-2278, or an approved equal.

Mulch shall be applied at a rate of three thousand (3,000) pounds per acre.

#### 9-14.5(4) Erosion Control Matting

Erosion control matting shall consist of a three-dimensional geomatrix of heavy nylon monofilaments fused at their intersections, such as Enkamat, manufactured by Akzo Nobel Geosynthetics Co., P.O.Box 1057, Enka, NC 28728, Telephone 704-665-5050, or an approved equal.

##### 9-14.5(4)1 Description of Materials

Matting shall be three-dimensional geomatrix of heavy nylon monofilaments fused at their intersection. Ninety-seven (97%) of the geomatrix shall be open space available for soil and root interaction with the filaments.

Matting will have three-dimensional stability without laminated or stitched layers. Matting must also meet specific dimensions and physical properties listed in Table 9-14-1.

**TABLE 9-14-1 TYPICAL PHYSICAL PROPERTIES AND DIMENSIONS**

<b>ENKAMAT</b>	<b>7020</b>
<b>Dimensions</b>	
Weight oz/yd 2 (g/m2)	12.0 (407)
Weight oz/yd 2 (g/m2) MARV	11.0 (373)
Thickness inches (mm)	.7 (17.8)
Width inches (cm)	39 (99)
Roll Length feet (m)	277 (84.5)
Area yd 2 /roll (m2/roll)	100 (83.6)
Roll Gross Weight lbs. (kg)	77 (34.9)
<b>ENKAMAT</b>	<b>7020</b>
<b>Typical Physical Properties</b>	
Tensile Strength - Length lbs/ft (kN/m)	240 (3.5)
Tensile Strength - Width lbs/ft (kN/m)	125 (1.82)
Tensile Elongation - Length (%)	75
Tensile Elongation - Width (%)	60
Area Holding Capacity inch 3/yd 2 (cm3/m2)	862 (16895)
Max. Shear Resistance lbs/Ft 2 (kN/m2)	8 (39.1)

#### 9-14.5(5) Reinforced Channel Lining

Reinforced channel lining shall consist of a 100% recycled nylon fiber matrix sewn between an extra heavy, UV stabilized top net and a heavy, UV stabilized bottom net, such as P300, manufactured by North American Green, 14649 Highway 41 North, Evansville, IN 47711, Telephone 812-867-6632NC 28728, or an approved equal.

**9-14.5(5)1 Description of Materials**

Reinforced channel lining shall consist of 100% recycled nylon 6.6 fiber sewn between a black UV stabilized 1/2 inch mesh polypropylene netting on top (5 lbs./ 1000 sq.ft.) and a black UV stabilized 5/8 inch mesh polypropylene netting on the bottom (3 lbs./1000 sq.ft.) with polyester thread.

The lining shall be resistant to photo and chemical degradation. The lining material must also meet specific dimensions and physical properties listed in Table 9-14-2.

**TABLE 9-14-2 TYPICAL PHYSICAL AND SUPPLEMENTAL SPECIFICATIONS**

<b>Physical Specifications</b>			
<b>(Roll)</b>			
<b>Width</b>	<b>Length</b>	<b>Weight</b>	<b>Area</b>
6.5 Feet (2m)	83.5 feet (25.4m)	48 lbs ± 10% (21.8 kg)	60 sq yd (50m <sup>2</sup> )
<b>Supplemental Specification</b>			
<b>Property</b>	<b>Lab Method</b>	<b>Value</b>	<b>Units</b>
Ground Cover	Image Analysis	93	%
Thickness	ASTM D1777	.235	in
Porosity	Calculated	94	%
Resiliency	100 PSI - 3 Cycles	90	%
Mass per unit area	ASTM D3776	12.8	oz/y <sup>2</sup>
Tensile Strength	ASTM D4632	37.7	lbs
Elongation	ASTM D4632	31.0	%
Tensile Strength	ASTM D4595	273.6	lbs/ft
Elongation	ASTM D4595	24	%
Tensile Strength	ASTM D1682	156.3	lbs/ft
Flexibility	ASTM D1388-64	23,695	mg-cm
UV Resistance			
Tensile Strength Retained After UV/Water Exposure	ASTM D4355/D1682 <sup>1</sup>	96.9	%
Elongation	ASTM D4355/D1682 <sup>1</sup>	94.1	%

<sup>1</sup> ASTM D1682 used to measure initial and remaining material tensile strengths and elongation.

**9-33 CONSTRUCTION GEOTEXTILE** - Add the following new sections and property requirements:

**9-33.1(1) Cushion Geotextile** - Add the following new section:

The cushion geotextile shall be composed of needle punched fibers. Fibers used in the manufacture of the geotextile shall consist of a material composed of at least 85 percent

by weight polyolefins, polyesters, or polyamides. The cushion geotextile shall meet the properties listed in Table 9-33-1

The geotextile and threads used in sewing the geotextile shall be chemically resistant to commonly encountered hazardous waste leachate, rot and mildew. The geotextile and threads used in sewing the geotextile shall also contain stabilizers or inhibitors to limit degradation due to ultraviolet (UV) light exposure. Polymeric thread used for sewing shall exhibit chemical and UV resistance equal to or exceeding that of the geotextile.

**TABLE 9-33-1 GEOTEXTILE CUSHION PROPERTIES**

Property	Units	Specified Value	Test Method
Unit Weight	OZ./S.Y.	16	ASTM D-3776
Tensile Strength (pounds)	LBS.	275	ASTM D-4632
Sewn Seam Tensile Strength	LBS.	138	ASTM D-4632
Puncture Strength	LBS.	185	ASTM D-4833
Mullen Burst Strength	PSI	590	ASTM D-3786
Trapezoidal Tear Strength	LBS.	115	ASTM D-4533
Ultraviolet Stability	%	70	ASTM D-4355

Notes:

1. All numerical values represent minimum average roll values (i.e., average of test results from any sampled roll in a lot shall meet or exceed the minimum average roll values in the table) in weaker principal direction. Lot sampled according to ASTM D-4354, "Practice for Sampling Geosynthetics for Testing."

2. Minimum seam strength when sewn seams are required. Property is not applicable to overlapped seams.

3. Wide Width Test (ASTM D 4595) will not be required for the cushion geotextile application.

**9-33.1(2) Geocomposite Drainage Net - Add the following new section:**

The geocomposite drainage net shall consist of a polyethylene net mesh specifically fabricated for use as a drainage medium, heat bonded to a 6 oz. nonwoven geotextile fabric on both sides. Minimum physical properties shall be as follows:

**TABLE 9-33-3 GEOCOMPOSITE DRAINAGE NET PROPERTIES**

<u>Geocomposite Properties</u>	<u>Minimum Average Values</u>	<u>ASTM Standards</u>
Transmissivity @ 1,000 psf, m <sup>2</sup> /sec	1 x 10 <sup>-3</sup>	ASTM D-4716
Transmissivity @ 10,000 psf, m <sup>2</sup> /sec	5 x 10 <sup>-4</sup>	
<u>Geonet Properties</u>	<u>Average Values</u>	<u>ASTM Standard</u>
Thickness, mil	200	ASTM D-5199
Density, g/cm <sup>3</sup>	0.94	ASTM D-1505
Tensile Strength (MD), lb/in	45	ASTM D-5034/5035
Carbon Black Content, %	2.0	ASTM D-1603/4218
Crush Strength, psi	>50	ASTM D-1621
<u>Geotextile Properties</u>	<u>Minimum Average Values</u>	<u>ASTM Standard</u>
Structure	Nonwoven	
Apparent Opening Size (AOS)	< 0.3 mm	ASTM D-4751
Flow Rate, gpm/ft <sup>2</sup>	95	ASTM D-4491
Grab Tensile, lb	205 lbs	ASTM D-4632
Puncture Strength, lb	95 lbs	ASTM D-4833

Typically, the geonet and geotextile are purchased as a geocomposite where the geotextile is bonded to one side of the geonet during the manufacturing process. The advantage of a geocomposite is ease of installation and better quality control during construction. The tables above list the minimum specifications for the geonet and geotextile.

The materials supplied under these special provisions shall be first quality products designed and manufactured specifically for the purposes of this work and which have been satisfactorily demonstrated by prior use to be suitable and durable for such purposes. The materials shall be compounded of high quality ingredients to produce flexible durable membranes. All ingredients shall be well dispersed through the compound prior to being formed into membranes. No water soluble ingredients can be used in the compound, nor can the ingredients contain water soluble components.

The resultant membranes shall be free from dirt, oil, foreign matter, creases, tears, holes, or other defects.

### 9-33.1(3) Geotextile Installation

1. All geotextiles shall be handled in a manner to ensure they are not damaged.
2. On slopes, the geotextiles shall be secured in the anchor trench and then rolled down the slope in such a manner as to continually keep the geotextile sheet in sufficient tension to preclude folds and wrinkles.
3. In the presence of wind, all geotextiles shall be weighted with sand bags or equivalent.

4. Geotextiles shall be cut using an approved cutter. If the material is being cut in place, special care must be taken to protect other geosynthetic materials from damage.
5. Care shall be taken not to entrap stores or excessive dust that could damage the geomembrane, or generate clogging of drains or filters.
6. Seams shall be overlapped at least 12 inches.
7. Repairs - Any holes or tears in the geotextile shall be repaired as follows:
  - a) On slopes - A patch made from the same geotextile shall be seamed into place. Should any tear exceed 10% of the width of the roll, that roll shall be removed from the slope and replaced.
  - b) Horizontal areas - A patch made from the same geotextile shall be spot-seamed in place with a minimum of twelve inches (12") overlap in all directions.
8. During geotextile placement, the QA personnel shall verify the following:
  - a) The geotextile is cut only with an approved cutter, and is not torn or ripped.
  - b) The thread used to sew the panels together meets specification requirements.
  - c) The panels are being joined in accordance with the Plans and Specifications.
  - d) Any roll of geotextile with a tear exceeding ten (10) percent of the roll width is removed and replaced.

**9-33.2 Geotextile Properties** - Add wide width test properties to Tables 1 and 3 (WSDOT 9-33.2) and modify properties in Table 3 (WSDOT 9-33.2):

**Table 1**  
**Geotextile for underground drainage strength properties for survivability**

Geotextile Property	Test Method	Low Survivability Woven/Nonwoven	Moderate Survivability Woven/Nonwoven
Wide Width Tensile Ultimate, Machine Direction 6oz/yd <sup>2</sup> 12oz/yd <sup>2</sup>	ASTM D 4595	70/30 P/in min 150/80 P/in min	90/35 P/in min 180-/85 P/in min

**Table 3**  
**Geotextile for separation or soil stabilization**

Geotextile Property	Test Method	Separation Woven/Nonwoven	Soil Stabilization Woven/Nonwoven
AOS for LCRS	ASTM D4751	0.85 mm max (#20 U.S. Sieve)	-
AOS for LDCRS	ASTM D4751	0.21 mm max (#70 U.S. Sieve)	-
Mullen Burst	ASTM D3786	- / 290 psi min	-/330 psi min
Wide Width Tensile Ultimate, Machine Direction 6oz/yd <sup>2</sup> 12oz/yd <sup>2</sup>	ASTM D4595	70/30 P/in min 150/80 P/in min	90/35 P/in min 180/85 P/in min

**Table 4**  
**Geotextile for permanent erosion and ditch lining**

Geotextile Property	Test Method <sup>2</sup>	Geotextile Property Requirements <sup>1</sup>		
		Permanent Erosion Control		Ditch Lining
		Moderate Survivability Woven/Nonwoven	High Survivability Woven/Nonwoven	Woven/ Nonwoven
AOS	ASTM D 4751	See Table 5	See Table 5	.60 mm max (#30 sieve)
Water Permittivity	ASTM D 4491	See Table 5	See Table 5	.02 sec <sup>-1</sup> min.
Grab Tensile Strength, min. in machine and x-machine direction	ASTM D 4632	250 lbs/160 lbs. min.	315 lbs/200 lbs. min.	250 lbs./160 lbs. min.
Grab Failure Strain, in machine and x-machine direction	ASTM D 4632	15%-50%/>50%	15%-50%/>50%	<50%/≥50%
Seam Breaking Strength	ASTM D 4632 <sup>3</sup>	220 lbs./140 lbs. min.	270 lbs./180 lbs. min.	220 lbs./140 lbs. min.
Burst Strength	ASTM D 3786	400 psi/190 psi min.	500 psi/320 psi min.	
Puncture Resistance	ASTM D 4833	80 lbs./150 lbs. min.	112 lbs./79 lbs. min.	80 lbs/50 lbs. min.
Tear Strength, min. in machine and x-machine direction	ASTM D 4533	80 lbs./50 lbs. min.	112 lbs./79 lbs. min.	80 lbs/50 lbs. min.
Ultraviolet (UV) Radiation stability	ASTM D 4355	70% strength retained min., after 500 hrs. in weatherometer	70% strength retained min., after 500 hrs. in weatherometer	70% strength retained min., after 500 hrs. in weatherometer

<sup>1</sup>All geotextile properties in Tables 1 through 6 are minimum average roll values (i.e., the test results for any sampled roll in a lot shall meet or exceed the values shown in the table).

<sup>2</sup>The test procedures used are essentially in conformance with the most recently approved ASTM geotextile test procedures, except for geotextile sampling and specimen conditioning, which are in accordance with WSDOT Test Methods 914 and 915, respectively. Copies of these test methods are available at the Olympia Service Center Materials Laboratory in Tumwater.

<sup>3</sup>With seam located in the center of 8-inch long specimen oriented parallel to grip faces.

### 9-34 BENTONITE - Add the following new section:

Bentonite to be mixed with site materials shall be a natural, powdered Wyoming-type sodium bentonite meeting the properties listed in Table 9-34-1. Bentonite shall be a naturally occurring clay composed principally of mineral sodium montmorillonite.

**TABLE 9-34-1 BENTONITE PROPERTIES**

Property	Test Method	Required Value	Test Frequency
Free Swell	ACC 1010	24 ml/2g min.	60 tons
Filtrate Loss	API 13A/13B	15 ml max.	50 tons
Moisture Content	ACC 1009	10% max.	50 tons
Particle Sizing	ASTM D 422	70% min. - #200	50 tons

#### 9-34.1 Submittals

The Contractor shall submit the following to the Engineer for approval:

1. Identification of the bentonite supplier;

2. List of the physical and chemical properties of the bentonite;
3. A representative sample (10 lbs.) of the bentonite to be supplied; and
4. Manufacturer's Certificate of Compliance verifying the materials to be supplied conform to these Specifications.

**9-35 GEOSYNTHETIC LINERS** - Add the following new section:

This special provision addresses geomembranes and geosynthetic clay liners.

The Contractor shall provide to the Engineer the names of the manufacturers of all geosynthetic liner materials proposed for inclusion in the work. This includes geomembrane, geosynthetic clay liner (GCL), geocomposite, and cushion geotextile materials proposed for constructing the liner system. These materials shall conform in every respect to these special provisions.

The Contractor shall provide to the Engineer six (6) samples of each liner component material. Each sample shall be 15 inches wide by 15 inches long. The material will be tested for critical interface shear strengths between the various liner components. The interface testing program shall be performed by the Engineer and is described in the Remedial Action Comprehensive Plans and Documents, Addendum A, CQAP for PA 1.0.

The Contractor shall not have materials scheduled for delivery until results of the CQA interface testing program verifies the following residual shear strength values for normal stresses up to 10,000 psf:

- Equal to or greater than 11.5 degrees between the geocomposite and the DST 60 mil HDPE.
- Equal to or greater than 14.5 degrees between the GCL and the geocomposite.
- Equal to or greater than 22 degrees between the DST 60 mil HDPE and the compacted low-permeability soil.

**9-35.1 High Density Polyethylene (HDPE) Liner**

**9-35.1(1) Acceptable Manufacturers**

Textured high density polyethylene (HDPE) geomembrane shall be produced from specially formulated, virgin polyethylene resins as manufactured by: GSE Lining Technology, Inc., 19103 Gundle Road, Houston, TX 77073, 1-800-435-2008; Layfield Plastics, Inc., 3890 Hammer Drive, Bellingham, WA 98226, Telephone 1-800-796-6868; National Seal Co., 1245 Corporate Boulevard, Suite 300, Aurora, IL 60504, Telephone 1-800-323-3820; Poly-flex, Inc., 2000 W. Marshall Drive, Grand Prairie, TX 75051, Telephone 1-800-527-3322, or an approved equal.



### 9-35.1(2) Definitions Used in This Section

1. Alloys, Polymeric: A blend of two or more polymers such as a rubber and a plastic to modify a given property; e.g., tensile strength.
2. Air Lance: A commonly used nondestructive test method performed with a stream of air forced through a nozzle at the end of a hollow metal tube to determine seam continuity and tightness of relatively thin, flexible geomembranes.
3. Adhesive: A chemical system used in the bonding of geomembranes. The adhesive residue results in an additional element in the seamed area. (Manufacturers and fabricators should be consulted for the various types of adhesives used with specific geomembranes.)
4. Batch: A quantity of resin, usually the capacity of one railcar, used in the fabrication of high density polyethylene geomembrane roll. The finished roll will be identified by a roll number corresponding to the resin batch used.
5. Bodied Chemical Fusion Agent: A chemical fluid containing a portion of the parent geomembrane that, after application of pressure and after the passage of time, results in the chemical fusion of two essentially similar geomembrane sheet, leaving behind only that portion of the parent material.
6. Bridging: Condition existing when the geosynthetic is not in contact with the underlying material.
7. Chlorinated Polyethylene (CPE): Family of polymers produced by the chemical reaction of chlorine with polyethylene. The resultant polymers presently contain 25-45% chlorine by weight and 0-25% crystallinity. CPE will be used to designate thermoplastic liners, CM will be used to designate vulcanized liners.
8. Contractor: The person, firm or corporation with whom Owner has entered into the Agreement.
9. CPER: Same product as CPE but with a polyester reinforcement (scrim) built into the construction to give additional strength and stability.
10. Chlorosulfinated Polyethylene (CSPE): Family of polymers produced by the reaction of polyethylene with chlorine and sulfur dioxide. Present polymers contain 25-43% chlorine and 1.0-1.4% sulfur.
11. Chemical Fusion: The chemically-induced reorganization in the polymeric structure of the surface of a polymer geomembrane that, after the application of pressure and the passage of time, results in the chemical fusion of two essentially similar geomembrane sheets being permanently joined together.
12. Construction Quality Assurance (CQA): A planned system of activities whose purpose is to provide an evaluation of the completed liner and initiate corrective action where necessary.
13. Construction Quality Control: Actions that provide a means of monitoring and measuring the quality of the product as it is being installed.
14. CQA Monitor: Owner's representative responsible for observing and documenting activities related to quality assurance during construction.

15. **Curing:** The strength gain over time of a chemically fused, bodied chemically fused, or chemical adhesive geomembrane seam due primarily to evaporation of solvents or crosslinking of the organic phase of the mixture.
16. **Destructive Tests:** Tests performed on geomembrane samples cut out of a field installation or test strip to verify specifications performance requirements, e.g., shear and peel tests of geomembrane seams during which the specimens are destroyed.
17. **Environmental Stress Crack (ESC):** External or internal stress propagation in a plastic caused by environmental conditions which are usually chemical or thermal in nature.
18. **Extrudate:** Geosynthetic material produced in the form of a rod to be used by the Installer to extrusion weld panels of geomembrane together.
19. **Fabricator:** An individual, firm or corporation that fabricates geomembrane liner panels from geomembrane roll goods.
20. **Factory Seams:** The seaming of geomembrane rolls together in a factory to make large panels to reduce the number of field seams
21. **Field Seams:** The seaming of geomembrane rolls or panels together in the field making a continuous liner system.
22. **Flexible Membrane Liner (FML):** Synonymous term for geomembrane.
23. **Flood Coating:** The generous application of a bodied chemical compound, or chemical adhesive compound to protect exposed yarns in scrim reinforced geomembranes.
24. **Geomembrane:** An essentially impermeable synthetic membrane used as a solid or liquid barrier. Synonymous term for flexible membrane liner (FML).
25. **Geomembrane Subsurface:** Material surface upon which geomembrane will be placed.
26. **Geosynthetics:** Products manufactured from polymeric material to be used with geotechnical engineering-related materials as an integral part of civil engineering works. Geosynthetics include geomembranes, geotextiles, geocomposites, and HDPE pipe.
27. **Geosynthetic Quality Assurance Laboratory (Third Party Laboratory):** The party, independent from the Owner, Manufacturer, and Installer, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site.
28. **Geotextile:** Any permeable textile used with foundation, soil, rock, earth, or any other geotechnical engineering-related material as an integral part of a human-made project, structure, or system.
29. **Gun:** Synonymous term for hand held hot air device.
30. **Installer:** An individual, firm or corporation that installs fabricated geomembrane liner panels and/or roll goods and field seams them into a complete geomembrane liner system.
31. **Manufacturer:** An individual, firm or corporation that produces sheet or roll geomembrane from resins stabilizers, and other additives.
32. **Nondestructive Test:** A test method which does not require the removal of samples from, nor damage to, the installed liner system. The evaluation is done in an in-situ manner. The results do not indicate the seam's mechanical strength. Typical nondestructive tests are air-lance and vacuum box methods.

33. Panel: The unit area of geomembrane, a roll or a portion of a roll, that will be seamed in the field.
34. Panel Layout Drawings: Drawings submitted by the Installer showing a tentative panel layout indicating panel numbers, field seams and details.
35. Plasticizer: A material, generally an organic liquid, incorporated in a plastic or rubber formulation to soften the resin polymer and improve flexibility, ductility and extensibility.
36. Polyethylene: A semi-crystalline thermoplastic polymer composition prepared from polymerized ethylene monomer(s) and stabilizers such as antioxidants and pigmentation. Membranes can be manufactured from High Density Polyethylene (HDPE), Very Low Density Polyethylene (VLDPE), or both, and can incorporate specialty surfacings such as texturing, reflective coloration, or electrically conductive laminations as specified.
37. Polymer: A carbon based organic chemical material formed by the chemical reaction of monomers having either the same or different chemical structures.
38. Polyvinyl Chloride (PVC): A non-crystalline thermoplastic polymer composition prepared from polymerized vinyl monomer by blending with one or more low or non-volatile plastisizers made by polymerizing vinyl chloride monomer.
39. Scrim Designation: The weight and number of yarns of fabric reinforcement per inch of length and width, e.g., a 10 X 10 scrim has 10 yarns per inch in both the machine and cross machine direction.
40. Sealant: A viscous chemical used to seal the exposed edges of scrim reinforced geomembranes. (Manufacturers and installers should be consulted for the various types of sealant used with specific membranes).
41. Seaming Boards: Smooth wooden boards (preferably 1" X 12" X 8', or more), placed beneath the area to be seamed to provide a uniform surface to applied roller pressure in the fabrication of field seams.
42. Subcontractor: An individual, firm or corporation having a direct contract with Contractor or with any other subcontractor for the performance of a part of the work at the site.
43. Tensiometer: A device containing a set of opposing grips used to place a geomembrane seam in tension for evaluating its strength in shear or in peel.
44. Test Strips: Trial sections of seamed geomembranes used to establish methods and materials for chemical and chemical adhesive seams under a specific set of atmospheric conditions.
45. Thermal Fusion: The temporary, thermally-induced reorganization in the polymeric make-up of the surface of a polymer geomembrane that, after the application of pressure and the passage of a certain amount of time, results in the two geomembranes being permanently joined together.
46. Vacuum Box: A nondestructive test method which develops a vacuum in a localized region of a geomembrane seam in order to evaluate the seam's tightness and suitability.
47. Wicking: The phenomenon of liquid transmission within the fabric yarns of reinforced geomembranes via capillary action.

**9-35.1(3) Quality Assurance**

1. Company qualifications:
  - a. The installation company shall have worked in a similar capacity on at least 5 projects similar in complexity to this project with each project involving at least 500,000 square feet of a similar polyethylene product.
  - b. The installation company shall have installed a minimum of 10 million square feet of polyethylene geomembrane.
2. Personnel qualifications:
  - a. Installation supervisor/field engineer shall have worked in a similar capacity on at least 2 jobs similar in size and complexity to this project.
  - b. The master seamer shall have completed a minimum of 5,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for use on this project.
  - c. Other seamers shall have seamed a minimum of 1,000,000 square feet of geomembrane.
3. Manufacturer Source Quality Control.

The manufacturer shall perform the quality control tests listed in Table 9-35-1 at the manufacturing plant. Quality control certificate shall be provided to the Engineer as specified in Section 9-35.1(4)B of these Special Provisions.
4. Quality Assurance by Owner.

The Owner may engage the services of a Construction Quality Assurance Consultant (CQAC) for monitoring the quality and installation of material. The Contractor shall cooperate fully with supplemental testing performed by the CQAC and shall make available samples required for such testing.
5. Delivery, Storage and Handling
  - a. Deliver geomembrane to the site only after the Engineer receives and approves the required submittals. Damaged or unacceptable material shall be immediately removed from the site and replaced at no cost to the Owner.
  - b. Space to store the geomembrane rolls or pallets will be designated by the Engineer. Store geomembrane rolls or pallets to protect from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or other damage. Stack geomembrane no more than 3 rolls or 1 pallet high.
  - c. Use appropriate handling equipment to load, move or deploy geomembrane rolls or panels. Appropriate handling equipment includes cloth chokers and spreader bar for loading, spreader and roll bars for deployment. Do not fold geomembrane material. Geomembrane damaged during handling shall be repaired to the satisfaction of the Engineer. Geomembrane irreparably damaged, as determined by the

Engineer, shall be immediately removed from the site and replaced. Repair, removal and replacement shall be solely at the Contractor's expense.

- d. Upon mobilization to the site the Engineer shall perform the following:
- 1) Verify the equipment used on site is adequate and does not risk damage to the geomembrane or other materials.
  - 2) Mark rolls or portions of rolls which appear damaged.
  - 3) Ensure that rolls are properly labeled and that labeling corresponds with Quality Control documentation and Shipping Bills of Lading.

6. Warranty

- a. The installer of the geomembrane to be used in the work shall warrant his workmanship to be free of defects for 2 years after final acceptance of the work. This warranty shall include, but not be limited to, all seams, anchor trenches, geomembrane attachments to appurtenances, and penetration seals. The geosynthetic installer shall also obtain and furnish the Owner a warranty from the geomembrane manufacturer for the materials used. The material warranty shall be for defects or failure due to weathering for 10 years, with temperatures ranging from (-) minus 30 degrees Fahrenheit to (+) plus 110 degrees Fahrenheit, after the completion of the work on a prorata basis.
- b. Should a defect or failure occur within the aforesaid periods, the geosynthetic installer shall bear all costs for repair and/or replacement of the geomembrane and shall in addition bear all costs for the excavation of any cover backfill that is required to be removed in order to repair and/or replace the geomembrane. All materials removed to allow repairs to be made shall be reinstalled by the geosynthetic installer in accordance with these special provisions.

**TABLE 9-35-1 MANUFACTURER SOURCE QUALITY CONTROL TESTING**

TEST	TEST DESIGNATION	FREQUENCY (See Footnotes)
Sheet Thickness	ASTM D-1593, Para 9.1.3 or ASTM D-5994 (for textured sheets)	20 Per Roll
Oxidation Induction Time of Polyolefins	ASTM D-3895	(5)
Tensile Strength Yield	ASTM D-638	(3)
Tensile Strength Break	ASTM D-638	(3)
Elongation at Break	ASTM D-638	(3)
Elongation at Yield	ASTM D-638	(2)
Tear Resistance	ASTM D-1004, Die C	(3)
Puncture Resistance	ASTM D-4833	(3)
Resistance to Soil Burial	ASTM D-3083, Using ASTM D-638 Type IV	(4)
Dimensional Stability, Each Direction	ASTM D-1204, 212 Degrees Fahrenheit (1 hr)	(1)

TEST	TEST DESIGNATION	FREQUENCY (See Footnotes)
Environmental Stress Crack	ASTM D-1693	(5)
Low Temperature Brittleness	ASTM D-746	(4)
Carbon Black Content	ASTM D-1603	(3)
Carbon Black Dispersion	ASTM D-3015	(3)
Footnotes:		
(1) One per 100,000 square feet of sheet produced or one per resin batch, whichever results in the greater number of tests.		
(2) One test on typical sheet and seam. Perform a shear test (ASTM D-638) on a sample obtained from the same sheet and a shear test (ASTM D-4437) on the seam.		
(3) One per 50,000 square feet or one per resin batch, whichever results in the greater number of tests.		
(4) Certification only required.		
(5) One test per resin batch.		

### 9-35.1(4) Submittals

- A. Two copies of the following documents shall be submitted by the Contractor no later than 3 weeks prior to production of the geomembrane.
1. Complete written instructions for storage, handling, installation and seaming of the geomembrane which are in compliance with these specifications and conditions of warranty.
  2. Panel layout drawings showing both fabricated and field seams, and details not conforming with the Plans (if any).
  3. Qualifications of the geomembrane fabricator shall include:
    - a. Fabrication schedule
    - b. Resume of the master seamer to be assigned to this project, including dates and duration of employment.
    - c. Resume of the Engineer or fabrication supervisor to be assigned to this project, including dates and duration of employment.
    - d. A list of personnel performing factory seaming operations, along with pertinent experience information.
  4. Qualification of the geomembrane installer, including:
    - a. A drawing showing the installation panel layout identifying both fabricated (if applicable) and field seams, as well as any variance or additional details which deviate from the engineering drawings. The layout shall be adequate for use as a construction plan and shall include dimensions, details, etc.
    - b. Installation schedule.
    - c. Resume of the master seamer to be assigned to this project, including dates and duration of employment.
    - d. Resume of the field engineer installation supervisor to be assigned to this project, including dates and duration of employment.

5. Installer's Quality Control Manual.
- B. The following documents shall be submitted to the Engineer prior to the shipment of the geomembrane to the Site:
1. Polyethylene Resin Data:
    - a. Statement of production date or dates.
    - b. Laboratory certification that the resin meets specifications.
    - c. Certification that all resin is from the same manufacturer.
    - d. Copy of quality control certificates issued by manufacturer.
    - e. Reports of tests defined in Table 9-35-1 from manufacturer.
  2. Geomembrane roll and extrudate data:
    - a. Statement of production date or dates
    - b. Laboratory certification that the materials meet the specification.
    - c. Copy of quality control certificates issued by the manufacturer.
    - d. Reports of tests defined in Table 9-35-1 from the manufacturer.
    - e. Statement that no reclaimed polymer is added to the resin.
    - f. Certification that the extrudate rod or bead is made of the same resin as the geomembrane.
  3. Manufacturer Source Quality Control test results as specified hereinafter.
- C. Submit the following prior to start of the geomembrane deployment:
1. Equipment list defining field seaming equipment by quantity and type.
  2. List of personnel assigned to perform the seaming operations.
  3. Sample warranties for material and installation as specified hereinafter for review by the Owner.
  4. Certificate of acceptance of prepared subgrade by geomembrane installer for each area to be covered by geomembrane, signed by the installation supervisor.
  5. Anchor trenches excavated in clay soils susceptible to desiccation cracks should be excavated only the distance required for that day's liner placement to minimize the potential of desiccation cracking.
- D. During installation, the Contractor shall submit the following QL documentation prepared by the Contractor during installation as specified hereinafter.
- E. Upon completion of the installation, the Contractor shall submit the following:
1. Certificate stating the geomembrane has been installed in accordance with the Contract Documents.
  2. Manufacturer's and Installer's warranties as specified hereinafter.
  3. Record drawings showing location of panels, seams, repairs, patches, and destructive samples, including detailed measurements.

**9-35.1(5) Materials****9-35.1(5)A Description of Materials**

Geomembrane liner shall be first quality product and manufactured specifically for the purposes of this work and shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes. The liner, resin, and extrudate shall be manufactured by one of the acceptable manufactures listed in Section 9-35.1(1).

**9-35.1(5)B Physical Characteristics**

1. Resin - Flexible membrane liner resin shall be new, first quality material compounded and manufactured specifically for the purpose of producing flexible membrane liners. All resins shall be of the same type and no batch shall be blended with recycles or seconds.

Resins shall meet the following specifications:

**TABLE 9-35-2 RESIN SPECIFICATIONS**

PROPERTY	REQUIREMENT	TEST METHOD
Specific Gravity*	< 0.935	ASTM D-792 Method A or ASTM D-1505
Melt Index	< 0.3 g per 10 minutes	ASTM D-1238 Condition 190/2.16

\* Measured prior to adding carbon black, pigments, or other additives.

Above tests shall be performed at a minimum frequency of one (1) per 50,000 square feet or one (1) per resin batch, whichever results in the greater number of tests.

2. Flexible Membrane Liner Roll - The flexible membrane liner roll shall meet the following requirements:
  - a. Processing aids, antioxidants and other additives other than carbon black shall not exceed a combined maximum total of 1 percent by weight.
  - b. Total combined percentage of processing aids, anti-oxidants, carbon black and other additives shall be less than 3.5 percent by weight of finished flexible membrane liner.
  - c. Materials shall be produced in North America.
  - d. Holes, pinholes, bubbles, blisters, gels or undispersed resins and undispersed carbon black in the flexible membrane liner will not be allowed. Nicks and cuts on roll edges will not be allowed.



- e. Flexible membrane liner shall be supplied in rolls. Folding will not be permitted. Identify each roll with labels indicating thickness, length and width, manufacturer, plant location, and manufacturer's roll identification number.
  - f. Flexible membrane liner shall meet the specifications listed in Table 9-35-2.
3. Extrudate Rod or Bead - Extrudate rod or bead shall be made from the same resin as the flexible membrane liner with carbon black. Additives shall be thoroughly dispersed in the extrudate. Contamination by foreign matter will not be allowed.

**TABLE 9-35-3 GEOMEMBRANE SPECIFICATIONS**

PROPERTY	VALUE		TEST METHOD
TEXTURED LINERS			
Thickness	40 mil	60 mil	ASTM D5994
Density. g/cc. (Min.)	0.94	0.94	ASTM D1505
Melt Flow Index. g/10 min.	≤1.0	≤1.0	ASTM D1238 Condition E
Carbon Black (%) (Min.)	2.0	2.0	ASTM D1603
Tensile Properties (Typical)			
1. Tensile Strength at Break lb/in - width	162	243	ASTM D638 Type IV
2. Tensile Strength at Yield lb/in - width	86	130	ASTM D638 Type IV
3. Elongation at Break (Percent)	500	560	ASTM D638 Type IV
4. Elongation at Yield (Percent)	13	13	ASTM D638 Type IV
Tear Resistance Initiation. lbs. (Typical)	30	45	ASTM D1004 Die C
Low Temperature Brittleness. °F (Typical)	-107	-107	ASTM D746 Procedure B
Dimensional Stability. % Change Each direction. (Max.)	±2	±2	ASTM D1204
Resistance to Soil Burial. Percent change in original value. (Typical)			ASTM D3083 using ASTM D638 Type IV
Tensile Strength at Break and Yield elongation at Break and Yield	±10 ±10	±10 ±10	% Change % Change
Environmental stress Crack. Hours. (Min.)	1500	1500	ASTM D1693
Puncture Resistance. Pounds. (Typical)	52	80	ASTM D4833
Coefficient of Linear Thermal Expansion X10 <sup>-4</sup> °C <sup>-1</sup> (Typical)	1.2	1.2	ASTM E831
Thermal Stability	100	100	ASTM D3895

Oxidative Induction Time (OIT).  
Minutes. (Min.)

200°C. Pure O<sub>2</sub> 1ATM

### **9-35.1(6) Installation**

#### **9-35.1(6)A. Subgrade Preparation**

The Contractor shall be responsible for accepting and maintaining the subgrade in a condition suitable for installation of the liner.

1. Prior to deployment of the geomembrane, the geomembrane installer and the Contractor shall inspect the subgrade to ascertain its suitability for installation in compliance with the terms of the product warranty and the requirements of this specification. The Contractor shall submit to the Engineer a certification signed by the Installer and the Contractor stating that the prepared surface is satisfactory. Installation of geomembrane without providing written certification shall constitute acceptance of the subgrade by the Installer and Contractor.
2. Excavate anchor trenches to the lines and widths shown on the Plans. Care shall be taken to ensure that the integrity of the anchor trench excavations remains intact between excavation and liner installation activities. Round edges of anchor trenches as recommended by the geomembrane manufacturer or cushion with geotextiles and backfill. Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetics. The QA personnel shall observe the backfilling operation.

#### **9-35.1(6)B. Geomembrane Installation**

1. Panel Marking - Each panel shall be assigned a simple and logical identifying code number or letter. Prior to commencement of liner deployment, the Contractor shall submit layout drawings to indicate the panel configuration and general location of field seams. The Contractor shall submit as-built drawings of the geomembrane identifying codes.
2. Daily Panel Installation - No more panels shall be installed in one day that can be seamed or tack welded during that same day.
3. General - Do not damage geomembrane by handling, traffic, or leakage of hydrocarbons or any other means. Do not wear damaging shoes or engage in activities that could damage the geomembrane. Unroll geomembrane panels using methods that will not damage, stretch or crimp the geomembrane. Prevent excess condensation on the geomembrane such that the underlying surface is not adversely impacted. Protect underlying surface from damage. Provide sufficient material to allow for geomembrane shrinkage and contraction. Use methods that minimize wrinkles between adjacent panels. Place ballast on geomembrane to prevent uplift from wind. Use ballast that will not damage geomembrane. Repair damage to subgrade or other underlying

materials prior to completing deployment of geomembrane. Do not allow vehicle traffic directly on geomembrane. Remove folded material.

Visually inspect geomembrane for imperfections. Mark faulty or suspect areas for testing and/or repair. Any portion of the lining damaged during installation shall be removed or repaired by using an additional piece of the same membrane as specified herein. The liner shall be installed in a relaxed condition and shall be free of stress or tension upon completion of the installation. Stretching the liner to fit is not permissible. Backfill anchor trenches.

4. **Weather Considerations** - Place and seam geomembrane only when ambient temperatures, measured six inches above the geomembrane, are between 40 degrees F and 100 degrees F, unless otherwise specified or approved. Installation below 40 degrees F shall occur only after verifying that the geomembrane can be seamed according to specifications and approval by the Engineer. Do not install geomembrane during precipitation, in the presence of excessive moisture, in areas of ponded water, or in the presence of excessive winds.

#### **9-35.1(6)C. Pipe and Manhole Boots**

Pipes, manholes, and other penetrations of the geomembrane shall be sealed with field fabricated boots as shown on the Plans. The flange portion of the boot shall match the angle of the slope or bottom where the pipe or manhole enters the liner for a smooth fit without excess stretching of the material.

#### **9-35.1(6)D. Seaming**

1. **Seam Layout** - Seam layout shall meet the following requirements:
  - a. Orient seams parallel to line of maximum slope, i.e., orient down, not across, slope.
  - b. Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.
  - c. Keep butt seams at least ten (10) feet horizontally away from toe of slope.
  - d. Use seam numbering system compatible with panel numbering system.
2. **Master Seamer** - At least one Master Seamer meeting the qualifications specified in Section 9-35.1(3)2.b. shall be present during all seaming operations. Additional seamers meeting the qualifications of Section 9-35.1(3)2.c. shall be utilized to avoid delaying work. The Master Seamer shall provide direct supervision over other seamers.

3. Seaming Equipment - Seaming equipment and accessories shall meet the following requirements:
  - a. Seaming apparatus shall be equipped with gauges giving temperatures in apparatus and at nozzle (extruding type).
  - b. Seaming apparatus shall use power source capable of providing constant voltage under combined line load.
  - c. Seaming apparatus shall be provided with protective lining and splash pad large enough to catch spilled fuel under electric generator when located on liner.
4. Trial Seaming - Trial seaming shall be accomplished by the Contractor on-site and shall meet the following requirements:
  - a. Conduct trial seams on pieces of geomembrane to verify adequate seaming methods and conditions.
  - b. Conduct trial seams:
    - 1) At beginning of each seaming period
    - 2) At least once for each four seaming hours
    - 3) For each seaming apparatus used
    - 4) At least once per shift for each person performing seaming
    - 5) When changes in climatic conditions or other changes could affect seam quality
  - c. Make test seam in the location of seaming and in contact with subgrade or geotextile (same condition as the geomembrane to be seamed.)
  - d. Make test seam sample at least three (3) feet long and eleven (11) inches wide with the seam centered lengthwise.
  - e. Cut two, 1-inch wide test strips from opposite ends of the trial seams.
  - f. Cut specimens constant 1-inch wide and clamp at 90 degree angle in tensiometer.
  - g. Quantitatively test specimens for peel adhesion first, and bonded seam strength (shear) second. Insure that these tests are performed in this order.
  - h. A trial seam sample passes when the following results are achieved for both peel and shear tests. For double-wedge welding, test both welds. In addition, both welds must pass in peel mode.
    - 1) The break is film tearing bond (FTB)
    - 2) The break is ductile
    - 3) The strength of break is:
      - a. 50 pounds per inch (ppi) for peel test (40-mil) and 70 ppi (60-mil)
      - b. 60 ppi for shear test (40-mil) and 100 ppi (60-mil)
  - i. Repeat the trial weld in its entirety if one (1) of the trial seam samples fails in either peel or shear mode.
  - j. When repeated trial seam fails, to not use seaming apparatus and seamer for welding until deficiencies or conditions are corrected and two (2) consecutive successful trial seams are achieved.

5. General Seaming Procedures - The seaming procedure used shall be as follows:
- a. Do not weld on liner until all trial seam test samples made by the equipment to be used passes tests as defined above.
  - b. Clean surface of grease, moisture, dust, dirt, debris or other foreign material.
  - c. Overlap panels by a minimum of three (3) inches for extrusion and four (4) inches for hot wedge seaming.
  - d. Do not use solvent or adhesive.
  - e. Provide adequate material on weld to allow peel testing of both sides of a double wedge seam.
  - f. Seaming shall extend to the outside edge of panels to be placed under the anchor berm and in the anchor trench.
  - g. If required, a firm substrate shall be provided by using a flat board, a conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support.
  - h. If seaming operations are carried out at night, adequate illumination shall be provided.
  - i. Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is less than three (3) inches shall then be patched with an oval or round patch of the same geomembrane extending a minimum of six (6) inches beyond the cut in all directions.
  - j. Seaming documentation - All seaming operations shall be documented by the Quality Control coordinator. Welding technicians will mark on the liner with mean streak permanent markers at the start of all seams information regarding date, time, welding technician ID, machine number, and machine operating temperature and speed. The Quality Control coordinator will record date, time, seam number, technician ID, machine ID, set temperature, speed, and weather conditions.
  - k. The following will be logged every two hours:
    - 1) Ambient temperature measured six (6) inches above geomembrane surface.
    - 2) Extrudate temperatures in barrel and at nozzle.
    - 3) Operating temperature of hot wedge.
    - 4) Preheat temperature.
  - l. Seam only when ambient temperature, measured six (6) inches above the geomembrane is between 40 degrees F and 100 degrees F unless other limits are accepted, in writing, by the Engineer.
  - m. If the Installer wishes to use methods which may allow seaming at ambient temperatures below 40 degrees F (5 degrees C) or above 100 degrees F (40 degrees C), then the Installer must demonstrate and certify that such methods produce seams which are entirely equivalent to seams produced at ambient temperatures between 40 degrees F (5 degrees C) and 100 degrees F (40 degrees C), and that the overall quality of the

geomembrane is not adversely affected. In addition, a change order to the contract between the Owner and the Contractor shall be required which specifically states that the seaming procedure does not cause any physical or chemical modification to the geomembrane that will generate any short or long term damage to the geomembrane. Only then will the temperatures in the above quality assurance procedure be modified accordingly.

6. Extrusion Type of Seaming:
  - a. Purge welding apparatus of heat-degraded extrudate before welding if extruder is stopped.
  - b. Clean seam surfaces of oxidation by disc grinder or equivalent not more than 1/2 hour before extruding seam.
  - c. Tack bond adjacent panels together using procedures that do not damage geomembrane.
  - d. Bevel edges of top geomembrane before extrusion welding.
  - e. Abrade liner surface a maximum of one-quarter (1/4) inch beyond weld bead area.
  - f. Grind ends of all seams when restarting seaming.
  - g. Do not remove more than 5 percent of geomembrane thickness when grinding.
  - h. Grind across, not parallel to, seams.
7. Hot Wedge Seaming - Welding apparatus shall be automated vehicular mounted devices equipped with devices giving applicable temperatures and pressures. Grind edges of cross seams to a smooth incline (top and bottom) prior to welding. Place smooth insulating plate or fabric beneath hot welding apparatus after usage. Protect against moisture build-up between sheets. When welding across previously placed seams, conduct trial seams at least every two hours, otherwise conduct trial seams once prior to start of work and once at mid-shift. Place a patch over the intersection of all seams.
8. During seaming operations the QA personnel shall verify the following:
  - a. The Lining Subcontractor has the number of seamers and spare parts agreed to in the pre-construction meeting.
  - b. Equipment used for seaming will not damage the FML.
  - c. The extruder is purged prior to beginning a seam until all the heat-degraded extrudate is removed (extrusion welding only).
  - d. Seam grinding has been completed less than one hour before seam welding (extrusion welding only).
  - e. The ambient temperature measured six inches above the FML surface is between 40 and 90 degrees Fahrenheit and the relative humidity is less than 80%.
  - f. The end of old welds, more than five minutes old, are ground to expose new material before restarting a weld (extrusion only).

- g. The weld is free of dust and other debris.
- h. For cross seams, the seam is ground to a smooth incline prior to welding.
- i. The seams are overlapped a minimum of four inches.
- j. No solvents or adhesives are present in the seam area.
- k. The procedure used to temporarily hold the panels together does not damage the panels and does not preclude QA testing.
- l. The panels are being seamed in accordance with the Plans and Specifications using the approved and proper equipment with gauges giving applicable temperatures.
- m. There is no free moisture in the weld area.
- n. The electric generator is placed on a smooth base such that no damage occurs to the FML.
- o. A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage.
- p. The geomembrane is protected from damage in heavily trafficked areas.
- q. Monitor and log all appropriate temperatures and conditions, and log and report to the QA personnel any non-compliances.

#### **9-35.1(6)E. Defects and Repairs**

##### **1. Inspection:**

- a. During installation and seaming, all seams and non-seam areas of the geomembrane shall be visually examined for defects, holes, blisters, undispersed raw materials and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of the examination. Areas suspected of deficiencies shall be marked. Areas of geomembrane requiring more than one patch per 5,000 square feet shall be removed and replaced at no additional cost to the Owner.
- b. Each suspect location both in seam and non-seam areas shall be repaired and non-destructively tested. Work shall not proceed with any materials which will cover locations which have been repaired until passing test results are achieved.

##### **2. Repair Procedures:**

- a. Any portion of the geomembrane exhibiting a flaw, or failing a destructive or non-destructive test, shall be repaired. The Contractor shall provide a written recommendation for method of repair to the Engineer prior to initiating repair and shall obtain approval of repair procedure from the Engineer prior to making repair. Methods which are acceptable to the Engineer and their application are as follows:
  - 1) Abrading and rewelding: For repair of small (less than 12 inches long) sections of seams.
  - 2) Spot welding or seaming: For repair of small tears (less than 2 inches long), pinholes or other minor, localized flaws where



- geomembrane thickness has been reduced by more than four (4) mils by excessive abrading or other means.
- 3) Capping: For repair of large lengths of failed seams.
  - 4) Patching: For repair of large (over 3/8-inch diameter) holes, tears (over 2 inches long), undispersed raw material, and contamination by foreign matter.
  - 5) Removing the unsatisfactory material and replacing with new material seamed into place.
- b. In addition, the following procedures shall be satisfied:
- 1) Surfaces of the geomembrane which are to be repaired shall be abraded no more than one-half (1/2) hour prior to the repair.
  - 2) All surfaces shall be clean and dry at the time of repair.
  - 3) Patches or caps shall extend at least six (6) inches beyond the edge of the defect and all corners of patches shall be rounded with a radius of at least three (3) inches.
  - 4) The geomembrane below large caps shall be cut to avoid water or gas collection between the sheets.
3. Verification of Repairs - Each patch shall be numbered and logged. Each repair shall be non-destructively tested using the methods described in Section 9-35.1(7) of these Special Provisions. Repairs which pass the non-destructive test shall be considered an adequate repair. Large caps shall be of sufficient length to require destructive test sampling, at the discretion of the Engineer. Repairs that have failed tests shall be redone and retested until a passing test results.

#### **9-35.1(6)F. Weather Conditions**

Geomembrane deployment will not occur during any precipitation, in the presence of excessive moisture (fog, dew), in an area of standing water, or during high winds.

#### **9-35.1(7) Testing**

##### **9-35.1(7)A. General:**

1. Manufacturer and installer shall participate in and conform with all terms and requirements of the Owner's quality assurance program and shall perform their own quality control program. The Contractor shall be responsible for assuring participation. Quality assurance requirements are as specified herein.
2. Quality control testing, including observation of the production and installation of the geosynthetics and laboratory testing of representative samples of the geosynthetics obtained during the installation, shall be performed by the Contractor. The Contractor shall provide the services of a Quality Control Technical Representative from the geomembrane manufacturer or installer to ensure compliance with the manufacturer's recommendations for handling and installing the geomembrane. The Quality Control Technical Representative

shall be present during installation, instruct the installers, observe the work, report unsatisfactory conditions, supervise testing, and make recommendations to the installer. Laboratory testing, field seam testing, and destructive testing shall be performed by the Contractor and observed by the Engineer.

3. Field seams shall be non-destructively tested over their full length using a vacuum test unit, air pressure (for double fusion seams only) or other approved methods. Non-destructive testing shall be carried out as the seaming progresses, not at the completion of all the field seaming. Required repairs shall be as specified herein.

#### **9-35.1(7)B. Conformance Testing**

Upon delivery of the geomembrane rolls, the Engineer may take additional samples beyond the minimum frequency stated below, and forward to a Geosynthetic Laboratory. Geosynthetic QA information shall be supplied by the material manufacturers and any associated subcontractors to ensure conformance to these specifications. The following shall be performed by the Geosynthetic Quality Assurance Laboratory:

1. Tests to determine the following characteristics shall be performed on the geomembranes.
  - a) Density
  - b) Carbon Black Content
  - c) Carbon Black Dispersion
  - d) Thickness (measured with micrometer or by weight per square area using laboratory-determined specific gravity, at several random locations on the sample.)
  - e) Tensile characteristics (yield strength, elongation at yield, break strength, elongation at break.)
  - f) Seam strength.
  - g) Puncture and tear resistance tests.
2. Test procedures shall comply with the following:
  - a) Density (ASTM D 792 Method A or ASTM D 1505)
  - b) Thickness (ASTM D 1593 or ASTM D 5994)
  - c) Tensile Strength (ASTM D 638)
  - d) Carbon Black Content (ASTM D 1603)
  - e) Carbon Black Dispersion (ASTM D 3015)
3. Sampling Procedures:
  - a) Samples shall be taken across the entire width of the roll and shall not include the first three feet. Unless otherwise specified, samples shall be taken at a rate of one per lot/batch or one per one hundred thousand (100,000) square feet, whichever is greater.

4. Test Results - The Geosynthetic Quality Assurance Laboratory shall provide copies of all test results to the Contractor and Engineer. The Engineer shall examine all results from laboratory conformance testing and shall report any non-conformance to the Contractor. Non-conforming areas shall be repaired as specified in 9-35.1(6)E of these Special Provisions.

#### 9-35.1(7)C. Vacuum Testing:

1. Vacuum testing shall meet the following requirements:
  - a. The equipment shall consist of the following:
    - 1) A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole, or valve assembly, and a vacuum gauge.
    - 2) A steel vacuum tank and pump assembly equipped with a pressure control and pipe connections.
    - 3) A rubber pressure/vacuum hose with fittings and connections.
    - 4) A soapy solution and applicator.
  - b. The following procedures shall be followed:
    - 1) Energize the vacuum pump and reduce the tank pressure to approximately ten (10) inches of water.
    - 2) Place the box over the wetted seam area (soapy solution).
    - 3) Ensure that a leak-tight seal is created.
    - 4) For a period of not less than fifteen (15) seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.
    - 5) All areas where soap bubbles appear shall be marked and repaired in accordance with repair procedures described in Section 9-35.1(6)E of these Specifications.

#### 9-35.1(7)D. Air Pressure Testing

The following procedures are applicable to those processes which produce a double seam with an enclosed space:

1. The equipment shall consist of the following:
  - a. An air pump (manual or motor driven) equipped with a pressure gauge capable of generating and sustaining a pressure over forty (40) psi and mounted on a cushion to protect the geomembrane.
  - b. A rubber hose with fittings and connections.
  - c. A sharp hollow needle, or other approved pressure feed device.
  - d. A pressure gauge with an accuracy of one (1) psi.
2. The following procedures shall be followed:
  - a. Seal both ends of the seam to be tested.

- b. Insert needle or other approved pressure feed device into the tunnel created by the fusion weld.
- c. Energize the air pump to a minimum pressure of forty (40) psi, close valve, and sustain pressure for at least five (5) minutes.
- d. If loss of pressure exceeds two (2) psi or ten (10) mm mercury or does not stabilize, locate faulty area and repair in accordance with repair procedures described in this Specification.
- e. Puncture opposite end of the seam to release air. If blockage is present, locate and re-test seam on both sides of blockage.
- f. Remove needle or other approved pressure feed device and repair the penetration holes using methods specified in Section 9-35.1(6)E of these Special Provisions.

**9-35.1(7)E. Destructive Testing:**

- 1. General - The Engineer will direct the Contractor to perform destructive seam tests at selected locations. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be performed as the seaming work progresses, not at the completion of all field seaming.
- 2. Location and Frequency:
  - a. Destructive test samples shall be collected at a minimum frequency of one (1) test location per five hundred (500) feet of seam length.
  - b. Samples, in addition to the minimum frequency, shall be taken as required by the Engineer.
  - c. Test location shall be determined during seaming and may be prompted by suspicion of excess heating, contamination, offset welds, or any other potential cause of imperfect welding. The Engineer will select the locations. The Engineer will not notify the Installer in advance of selecting locations where seam samples will be taken.
  - d. The Engineer reserves the right to increase the frequency in accordance with the actual performance results of samples taken.
- 3. Sampling Procedure:
  - a. Samples shall be cut at locations designated by the Engineer as the seaming progresses in order to obtain laboratory test results before the geomembrane is covered by another material. Each sample shall be numbered and the sample number, date, and ambient temperature. The sample location will be identified on the panel layout drawing.
  - b. All holes in the geomembrane resulting from destructive sampling shall be immediately repaired in accordance with repair procedures specified in Section 9-35.1(6)E of these Special Provisions.
- 4. Size of Samples - The samples shall be twelve (12) inches wide by forty-six (46) inches long with the seam centered lengthwise. Two (2) 1-inch wide strips shall

be cut from each end of the sample and these shall be tested (shear and peel) in the field by the installer. The remaining sample shall be cut into three (3) parts and distributed as follows:

- a. One (1) portion for the Contractor, twelve (12) inches by twelve (12) inches.
  - b. One (1) portion for testing by the Contractor's laboratory, 12 inches by 18 inches.
  - c. One (1) portion to the Engineer or archive storage, twelve (12) inches by twelve (12) inches.
5. Field Testing - The two (2), one (1) inch wide strips described in Section 9-35.1(7)E.4 above shall be tested in the field by the installer and witnessed by the Engineer, by tensiometer, for peel and shear, respectively. Test strips shall meet the peel and shear values specified for trial seams in Section 9-35.1(6)D.4. If any field test sample fails to pass, then the procedures outlined in that Section shall be applied.
6. Laboratory Testing - Laboratory testing shall be performed by the Geosynthetic Quality Assurance Laboratory paid for by the Contractor and approved by the Engineer. Testing shall include "Seam Strength" and "Peel Adhesion" (ASTM D638 with Type M-1, specimen one-half (1/2) inches wide, tested at two (2) inches per minute). The minimum acceptable values to be obtained in these tests are those indicated herein. At least five (5) specimens shall be tested for each test method. Specimens shall be selected alternately by test from the samples (i.e., peel, shear, peel, shear). If laboratory testing yields results less than the minimum values specified herein, the procedures defined in the following Section shall be applied.
7. Procedures for Destructive Test Failure - The following procedures shall apply whenever a sample fails the destructive test, whether performed by field or laboratory testing:
- a. The seam shall be reconstructed between any two (2) passed test locations, or
  - b. The seaming path can be traced to an intermediate location (at least ten (10) feet minimum from the location of the failed test in each direction) and a small sample taken for an additional field test at each location. If these additional samples pass the field tests, then full laboratory samples shall be taken. If these laboratory samples pass, then the seam shall be reconstructed between these locations. If either sample fails, then the process shall be repeated to establish the zone in which the seam should be reconstructed.
8. Acceptance of Seams - All acceptable seams must be bounded by two (2) locations from which samples passing laboratory destructive tests have been taken. In cases exceeding one hundred and fifty (150) feet of reconstructed

seam, a sample taken from within the reconstruction zone must pass destructive testing. Whenever a sample fails, additional testing may be required for seams that were seamed by the same personnel and/or apparatus or seamed during the same time shift.

#### **9-35.1(7)F. Geomembrane Wrinkle**

When seaming of a geomembrane liner is completed, or when seaming of a large area of a geomembrane liner is completed, and prior to placing overlying materials, the Engineer shall identify the location of excessive geomembrane wrinkles. Wrinkles so identified shall be cut and re-seamed and tested.

#### **9-35.1(7)G. Seams That Cannot Be Non-Destructively Tested**

The following procedures shall apply to locations where seams cannot be non-destructively tested:

1. All such seams shall be cap-stripped with the same geomembrane.
2. If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation.
3. If the seam cannot be tested prior to final installation, the seaming and cap-stripping operations shall be observed by the Engineer and Contractor for uniformity and completeness.

#### **9-35.1(7)H. Geomembrane Acceptance**

The Contractor shall retain ownership and responsibility for the geomembrane until acceptance by the Owner. The geomembrane shall be accepted by the Owner when:

1. Conformance test results meet the requirements of the Contract Documents.
2. Required documentation including warranty from the manufacturer, fabricator and installer has been received and accepted.
3. The installation is complete and accepted by the Engineer.
4. Verification of the adequacy of all field seams and repairs, including associated testing, is complete.
5. Written certification documents, including as-built drawings, have been received by the Engineer.

### **9-35.2 Polyvinyl Chloride (PVC) Geomembrane**

#### **9-35.2(1) Acceptable Manufacturers**

Flexible polyvinyl chloride (PVC) film shall be from blends of virgin PVC resins with softening agents (plasticizers) as manufactured by: Layfield Plastics, Inc., 3890 Hammer Drive, Bellingham, WA 98226, Telephone 800-796-6868; HPG International, Inc. 811 West River Drive, Temple Terrace, FL 33617, Telephone 813-983-0868; Integra

Plastics, Inc., 500 12<sup>th</sup> Street S.E., Madison, SD 57042, Telephone 800-578-5257; Watersaver Company, Inc., P.O.Box 16465, Denver, Co 80216-0465, Telephone 303-289-1818; Vernon Plastics Company, P.O. Box 8248, Shelley Road, Haverhill, MA 01835, Telephone 978-373-1551, or an approved equal.

#### **9-35.2(2) Definitions Used in This Section.**

1. **Air Lance.** A commonly used nondestructive test method performed with a stream of air forced through a nozzle at the end of a hollow metal tube to determine seam continuity and tightness of relatively thin, flexible geomembrane.
2. **Bodied Chemical Fusion Agent.** A chemical fluid containing a portion of the parent geomembrane that, after application of pressure and after the passage of time, results in the chemical fusion of two essentially similar geomembrane sheets, leaving behind only that portion of the parent material.
3. **Geomembrane.** An essentially impermeable synthetic membrane used as a solid or liquid barrier. Synonymous with flexible membrane liner (FML).
4. **Seaming Boards.** Smooth wooden boards, conveyor belt, or similar hard surface (preferably 1" X 12" X 8', or more), placed beneath the area to be seamed to provide a uniform surface to apply roller pressure in the fabrication of field seams.
5. **Tensiometer.** A device containing a set of opposing grips used to place a geomembrane seam in tension for evaluating its strength in shear or in peel.
6. **Vacuum Box.** A nondestructive test method which develops a vacuum in a localized region of a geomembrane seam in order to evaluate the seam's tightness and suitability.

#### **9-35.2(3) Quality Assurance**

1. **Company qualifications:**
  - a. The installation company shall have worked in a similar capacity on at least 5 projects similar in complexity to this project with each project involving at least 500,000 square feet of similar polyethylene product.
  - b. The installation company shall have installed a minimum of 10 million square feet of polyethylene geomembrane.

2. Personnel qualifications:
  - a. Installation supervisor/field engineer shall have worked in a similar capacity on at least 2 jobs similar in size and complexity to this project.
  - b. The master seamer shall have completed a minimum of 5,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for use on this project.
  - c. Other seamers shall have seamed a minimum of 1,000,000 square feet of geomembrane.
3. Manufacturer Source Quality Control.

The manufacturer shall perform the quality control tests listed in Table 9-35-3 at the manufacturing plant. Quality control certificate shall be provided to the Engineer as specified in Section 9-35.2(4)B of these Special Provisions.
4. Quality Assurance by Owner.

The Owner may engage the services of a Construction Quality Assurance Consultant (CQAC) for monitoring the quality and installation of material. The Contractor shall cooperate fully with supplemental testing performed by the CQAC and shall make available samples required for such testing.
5. Delivery, Storage and Handling
  - a. Deliver geomembrane to the site only after the Engineer receives and approves the required submittals. Damaged or unacceptable material shall be immediately removed from the site and replaced at no cost to the Owner.
  - b. Space to store the geomembrane rolls or pallets will be designated by the Engineer. Store geomembrane rolls or pallets to protect from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or other damage. Stack geomembrane no more than 3 rolls or 1 pallet high.
  - c. Use appropriate handling equipment to load, move or deploy geomembrane rolls or panels. Appropriate handling equipment includes cloth chokers and spreader bar for loading, spreader and roll bars for deployment. Do not fold geomembrane material. Geomembrane damaged during handling shall be repaired to the satisfaction of the Engineer. Geomembrane irreparably damaged, as determined by the Engineer, shall be immediately removed from the site and replaced. Repair, removal and replacement shall be solely at the Contractor's expense.
  - d. Upon mobilization to the site the Engineer shall perform the following:
    - 1) Verify the equipment used on site is adequate and does not risk damage to the geomembrane or other materials.
    - 2) Mark rolls or portions of rolls which appear damaged.



- 3) Ensure that rolls are properly labeled and that labeling corresponds with Quality Control documentation and Shipping Bills of Lading.

6. Warranty

- a. The installer of the geomembrane to be used in the work shall warrant his workmanship to be free of defects under normal usage for the proposed application after final acceptance of the work. This warranty shall include, but not be limited to, all seams, anchor trenches, geomembrane attachments to appurtenances, and penetration seals. The geosynthetic installer shall also obtain and furnish the Owner a warranty from the geomembrane manufacturer for the materials used. The material warranty shall be for defects or failure due to weathering, with temperatures ranging from (-) minus 30 degrees Fahrenheit to (+) plus 110 degrees Fahrenheit, during the length of the project.
- b. Should a defect or failure occur within the aforesaid periods, the geosynthetic installer shall bear all costs for repair and/or replacement of the geomembrane and shall in addition bear all costs for the excavation of any cover backfill that is required to be removed in order to repair and/or replace the geomembrane. All materials removed to allow repairs to be made shall be reinstalled by the geosynthetic installer in accordance with these special provisions.

9-35.2(4) Submittals

- A. Two copies of the following documents shall be submitted by the Contractor no later than 3 weeks prior to production of the geomembrane.
  1. Complete written instructions for storage, handling, installation and seaming of the geomembrane which are in compliance with these specifications and conditions of warranty.
  2. Panel layout drawings showing both fabricated and field seams, and details not conforming with the Plans (if any).
  3. Qualifications of the geomembrane fabricator shall include:
    - a. Fabrication schedule
    - b. Resume of the master seamer to be assigned to this project, including dates and duration of employment.
    - c. Resume of the Engineer or fabrication supervisor to be assigned to this project, including dates and duration of employment.
    - d. A list of personnel performing factory seaming operations, along with pertinent experience information.
  4. Qualification of the geomembrane installer, including:

- a. A drawing showing the installation panel layout identifying both fabricated (if applicable) and field seams, as well as any variance or additional details which deviate from the engineering drawings. The layout shall be adequate for use as a construction plan and shall include dimensions, details, etc.
  - b. Installation schedule.
  - c. Resume of the master seamer to be assigned to this project, including dates and duration of employment.
  - d. Resume of the field engineer installation supervisor to be assigned to this project, including dates and duration of employment.
5. Installer's Quality Control Manual.
- B. The following documents shall be submitted to the Engineer prior to the shipment of the geomembrane to the Site:
  1. Polymer compound data
    - a. Statement of production date or dates.
    - b. Laboratory certification that the materials meet Specifications.
    - c. Certification that all materials are from the same manufacturer.
    - d. Copy of quality control certificates issued by manufacturer.
    - e. Statement that no reclaimed polymer is added to the compound.
  2. Geomembrane data.
    - a. Statement of production date or dates
    - b. Laboratory certification that the materials meet the Specification.
    - c. Copy of quality control certificates issued by the manufacturer.
    - d. Reports of tests defined in Table 9-35-4 from the manufacturer.
  3. Manufacturer Source Quality Control test results as specified herein after.
- C. Submit the following prior to start of the geomembrane deployment:
  1. Equipment list defining field seaming equipment by quantity and type.
  2. List of personnel assigned to perform the seaming operations.
  3. Sample warranties for material and installation as specified hereinafter for review by the Owner.
  4. Certificate of acceptance of prepared subgrade by geomembrane installer for each area to be covered by geomembrane, signed by the installation supervisor.
  5. Anchor trenches excavated in clay soils susceptible to desiccation cracks should be excavated only the distance required for that day's liner placement to minimize the potential of desiccation cracking.

- D. During installation, the Contractor shall submit the following QL documentation prepared by the Contractor during installation as specified hereinafter.
- E. Upon completion of the installation, the Contractor shall submit the following:
  - 1. Certificate stating the geomembrane has been installed in accordance with the Contract Documents.
  - 2. Manufacturer's and Installer's warranties as specified hereinafter.
  - 3. Record drawings showing location of panels, seams, repairs, patches, and destructive samples, including detailed measurements.

TABLE 9-35-4 PVC LINER SPECIFICATIONS

Property	Test Method*	Units	Environmental PVC Geomembrane	
Thickness (nominal $\pm$ 5%)	ASTM D1593	Mils	20	30
Specific Gravity	ASTM D792		1.2 to 1.3	1.2 to 1.3
Minimum Tensile Properties (each direction):	ASTM D882			
1. Breaking Factor	Method A or B	lbs/inch width	46	69
2. Elongation at Break <sup>1</sup>	Method A or B	%	300	350
3. Modulus at 100% Elongation	Method A or B	lbs/inch width	20	30
Tear Resistance	ASTM D1004	Lbs.	6	8
Low Temperature	ASTM D1790	°F	-15	-20
Dimensional Stability	ASTM D1204	% max. change	3.5	3.5
Water Extraction	ASTM D1239	% loss max.	0.35	0.35
Volatile Loss	ASTM D1203	% loss max.	0.9	0.7
Resist. to soil burial:	ASTM D3083	% Change max.		
1. Breaking Factor			5	5
2. Elongation at Break			20	20
3. Modulus at 100% Elongation			20	20
Hydrostatic Resistance	ASTM D751 Method A	psi	60	85
Factory Seam Requirements <sup>2</sup>				
Bonded Seam Strength	ASTM D3083	ppi	35	50
Peel Adhesion	ASTM D413	psi	10	10
<sup>1</sup> The jaw separation method is to be used to determine elongation percent.				
<sup>2</sup> Factory bonded seam strength is the responsibility of the fabricator.				

**9-35.2(5) Materials****9-35.2(5)A Description of Materials**

Geomembrane liner shall be first quality product and manufactured specifically for the purposes of this work and shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes. The liner, resin, and extrudate shall be manufactured by one of the acceptable manufactures listed in Section 9-35.2(1).

**9-35.2(5)B Physical Characteristics**

1. 100% virgin polyvinyl chloride resin shall be used to formulate the geomembrane. The use of water soluble formulation ingredients is prohibited.
2. Geomembrane shall be uniform in color, thickness, size and surface texture. The material shall be a flexible, durable, watertight product free of pinholes, blisters, holes and contaminants.
3. Geomembrane shall have the minimum physical property characteristics, as outlined in Table 9-35-3. Certified test results showing that the sheeting meets or exceeds this specification shall be submitted per Section 9-35.2(4).

**9-35.2(6) Installation****9-35.2(6)A. Subgrade Preparation**

1. The area to be lined shall be drained and allowed to dry until firm enough for equipment to operate without rutting.
2. The surface to be lined shall be smooth and free of projections and sharp objects that can damage the lining. Remove all stumps and roots. Remove rocks, hard clods, and other such material, and roll the subgrade so as to provide a smooth compact surface. The smoothed subgrade will limit liner bridging to less than 1 inch.

**9-35.2(6)B. Geomembrane Installation**

1. Only install enough panels that can be seamed during that same day.
2. Do not damage geomembrane by handling, traffic, or leakage of hydrocarbons or any other means. Do not wear damaging shoes or engage in activities that could damage the geomembrane. Open or unroll geomembrane panels using methods that will not damage, stretch or crimp the geomembrane. Prevent excess condensation on the geomembrane such that the underlying surface is not adversely impacted. Protect underlying surface from damage. Provide

sufficient material to allow for geomembrane shrinkage and contraction. Use methods that minimize wrinkles between adjacent panels. Place ballast on geomembrane to prevent uplift from wind. Use ballast that will not damage geomembrane. Repair damage to subgrade or other underlying materials prior to completing deployment of geomembrane. Do not allow vehicle traffic directly on geomembrane. Remove folded material. Visually inspect geomembrane for imperfections. Mark faulty or suspect areas for testing and/or repair. Any portion of the lining damaged during installation shall be removed or repaired by using an additional piece of the same membrane as specified herein. The liner shall be installed in a relaxed condition and shall be free of stress or tension upon completion of the installation. Stretching the liner to fit is not permissible.

3. Place and seam geomembrane only when ambient temperatures, measured six inches above the geomembrane, are between 40 degrees F and 100 degrees F, unless otherwise specified or approved. Installation below 40 degrees F shall occur only after verifying that the geomembrane can be seamed according to Specifications and approval by the Engineer. Do not install geomembrane during precipitation, in the presence of excessive moisture, in areas of ponded water, or in the presence of excessive winds.
4. Protect the geomembrane from wind uplift during installation through the use of sand bags or other suitable weights. Repair all damaged geomembrane and test damaged areas prior to backfilling.

#### **9-35.2(6)C. Pipe Boots.**

Pipes, manholes, and other penetrations of the geomembrane shall be fitting and sealed with shop fabricated boots as shown on the Plans. The flange portion of the boot shall match the angle of the slope or bottom where the pipe or manhole enters the liner for a smooth fit without excess stretching of the material.

#### **9-35.2(6)D. Seaming**

1. Seam Layout - Seam layout shall meet the following requirements:
  - a. Orient seams parallel to line of maximum slope, i.e., orient down, not across, slope.
2. Trial field seaming shall be accomplished by the Contractor on-site and shall meet the following requirements:
  - a. Conduct trial seams on pieces of geomembrane to verify adequate seaming methods and conditions.
  - b. Conduct trial seams:
    - 1) at beginning of each seaming period
    - 2) at least once for each four seaming hours

- 3) for each seaming apparatus used
- 4) at least once per shift for each person performing seaming
- 5) when changes in climatic conditions or other changes could affect seam quality

Make test seam in the location of seaming and in contact with subgrade or geotextile (same condition as the geomembrane to be seamed.)

- c. Make test seam sample at least two (2) feet long and eleven (11) inches wide with the seam centered lengthwise.
  - d. Cut two, 1-inch wide test strips from opposite ends of the trial seams.
  - e. Cut specimens constant 1-inch wide and clamp at 90 degree angle in tensiometer.
  - f. Quantitatively test field specimens for peel adhesion (ASTM D-3083) first, and bonded seam strength (ASTM D-3083) second. Insure that these tests are performed in this order.
  - g. A trial seam sample passes when the following results are achieved for both tests.
    - 1) the break is film tearing bond (FTB)
    - 2) the break is ductile
    - 3) the strength of break is at least 80% of the specified sheet strength
  - h. Repeat the trial seam in its entirety if one (1) of the trial seam samples fails in either peel or shear mode.
  - i. When repeated trial seam fails, notify Engineer and do not continue seaming until deficiencies or adverse conditions are determined and corrected, and two (2) consecutive successful trial seams are achieved.
3. The seaming procedure used shall be as follows:
- a. Do not begin seaming on liner until all trial seam test samples made by the equipment to be used passes tests as defined above.
  - b. Field seams will be made to seal factory fabricated panels or rolls of geomembrane together in the field. Form seams per manufacturers written instructions. The contact surfaces of the panels shall be wiped clean to remove all dirt, dust or other substance. Solvent for cleaning contact surfaces of field joints and for other required uses shall be as recommended by the manufacturer. A hot wedge or hot knife seaming tool shall be applied to the overlapped panel edges creating a continuous thermal bond between the panels. Any wrinkles shall be smoothed out. Field seams shall have a strength of at least 80% of the specified sheet strength.
  - c. Seaming shall extend to the outside edge of panels
  - d. A firm substrate shall be provided by using a seaming board directly under the seam overlap to achieve proper support.
  - e. If seaming operations are carried out at night, adequate illumination shall be provided.

- f. "Fish mouths" or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut fish mouths or wrinkles shall be seamed and any portion where the overlap is less than three (3) inches shall then be patched with an oval or round patch of the same geomembrane extending a minimum of six (6) inches beyond the cut in all directions.
- g. Seam only when ambient temperature, measured 6 inches above the geomembrane is between 40 degrees F and 100 degrees F unless other limits are accepted, in writing, by the Engineer.

#### **9-35.2(6)E. Defects and Repairs**

##### **1. Inspection**

- a. During installation and seaming, all seams and non-seam areas of the geomembrane shall be visually examined for defects, holes, blisters, undispersed raw materials and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of the examination. Areas suspected of deficiencies shall be marked. Areas of geomembrane requiring more than one patch per 5,000 square feet shall be removed and replaced at no additional cost to the Owner.
- b. Each suspect location both in seam and non-seam areas shall be repaired and non-destructively tested. Work shall not proceed with any materials which will cover locations which have been repaired until passing test results are achieved.

##### **2. Repair Procedures**

- a. Repair all portions of the geomembrane exhibiting a flaw, or failing a destructive or non-destructive test. The Contractor shall provide a written recommendation for method of repair to the Engineer prior to initiating repair and shall obtain approval of the repair procedure from the Engineer prior to making repair. Methods which are acceptable to the Engineer and their application are as follows:
  - 1) Capping. Cap for repair of large lengths of failed seams.
  - 2) Patching. Patch large (over 3/8 inch diameter) holes, tears (over 2 inches long), undispersed raw material, and contamination by foreign matter.
  - 3) Remove and Replace. Remove the unsatisfactory material and replace with new material seamed into place.
- b. In addition, the following procedures shall be satisfied:
  - 1) Abrade surfaces of the geomembrane which need repaired no more than one-half (1/2) hour prior to the repair.
  - 2) Clean and dry all surfaces at the time of repair.



- 3) Extend patches or caps at least six (6) inches beyond the edge of the defect and all corners of patches shall be rounded with a radius of at least three (3) inches.
  - 4) Cut the geomembrane below large caps to avoid water or gas collection between the sheets.
3. Verification of Repairs - Each repair shall be non-destructively tested using the methods described in Section 9-35.2(7) of these Special Provisions. Repairs which pass the non-destructive test shall be considered an adequate repair. Large caps shall be of sufficient length to require destructive test sampling, at the discretion of the Engineer. Repairs that have failed tests shall be redone and retested until a passing test results.

### **9-35.2(7) Testing**

#### **9-35.2(7)A. General**

1. Quality control testing, including laboratory testing, field seam testing, and destructive testing shall be performed by the Contractor and observed at the discretion by the Engineer.
2. Field seams shall be non-destructively tested over their full length by pressurizing the seam if a dual-hot-wedge method was used in seaming, or using a vacuum test unit or other approved methods. Non-destructive testing shall be carried out as the seaming progresses, not at the completion of all the field seaming. Required repairs shall be as specified herein.

#### **9-35.2(7)B. Vacuum testing shall meet the following requirements.**

1. The equipment shall consist of the following:
  - a. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole, or valve assembly, and a vacuum gauge.
  - b. A steel vacuum tank and pump assembly equipped with a pressure control and pipe connections.
  - c. A rubber pressure/vacuum hose with fittings and connections.
  - d. A soapy solution and applicator.
    - 1) The following procedures shall be followed:
      - (a) Energize the vacuum pump and reduce the tank pressure to approximately ten (10) inches of water.
      - (b) Place the box over the wetted seam area (soapy solution).
      - (c) Ensure that a leak-tight seal is created.
      - (d) For a period of not less than fifteen (15) seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.

- (e) All areas where soap bubbles appear shall be marked and repaired in accordance with repair procedures described in Special Provision Section 9-35.2(6)E.
- (f) Conduct vacuum testing per ASTM 4437.

**9-35.2(7)C. Air Lance Testing shall meet the following requirements:**

1. Equipment shall consist of a 3/32" air nozzle that can provide a minimum air pressure of 30 psi and a maximum air pressure of 40 psi.
2. The following procedures shall be followed:
  - a. The air nozzle shall be held at a 45 degree angle to the field seam approximately 2" off the edge of the material.
  - b. The air shall be directed toward the seam edge, upper edge and surface to detect loose edges.
  - c. Riffles indicating unbonded areas within the seam or other undesirable seam conditions shall be patched in accordance with repair procedures described in Special Provision Section 9-35.2(6)E. The patch should then be tested using the same air lance test method.
  - d. Conduct air lance testing per ASTM 4437.

**9-35.2(7)D. Destructive Testing**

1. The Engineer will direct the Contractor to perform destructive seam tests at selected locations. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be performed as the seaming work progresses, not at the completion of all field seaming.
2. Location and Frequency
  - a. Destructive test samples shall be collected at a minimum frequency of one (1) test location per five hundred (500) feet of seam length.
  - b. Samples, in addition to the minimum frequency, shall be taken as required by the Engineer.
  - c. Test location shall be determined during seaming and may be prompted by suspicion of insufficient adhesive, contamination, offsets, or any other potential cause of imperfect seaming. The Engineer will select the locations. The Engineer will not notify the Installer in advance of selecting locations where seam samples will be taken.
  - d. The Engineer reserves the right to increase the frequency in accordance with the actual performance results of samples taken.
3. Sampling Procedure
  - a. Samples shall be cut at locations designated by the Engineer as the seaming progresses in order to obtain laboratory test results before the geomembrane is covered by another material. Each sample shall be

- numbered and the sample number and location identified on the panel layout drawing.
- b. All holes in the geomembrane resulting from destructive sampling shall be immediately repaired in accordance with repair procedures specified in Special Provision Section 9-35.2(6)E.
4. Size of Samples - The samples shall be eleven (11) inches wide by twenty-four (24) inches long with the seam centered lengthwise. Two (2) 1-inch wide strips shall be cut from each end of the sample and these shall be tested (shear and peel) in the field by the installer. The remaining sample shall be cut into two (2) parts and distributed as follows:
- a. One (1) portion for the Contractor, eleven (11) inches by eleven (11) inches.
  - b. One (1) portion to the Engineer or archive storage, eleven (11) inches by eleven (11) inches.
5. Field Testing - The two (2), one (1) inch wide strips described in Special Provision Section 9-35.2(7)D.4 shall be tested in the field by the installer and witnessed by the Engineer, by tensiometer, for peel and shear, respectively. Test strips shall meet the peel and shear values specified for trial seams in Special Provision Section 9-35.2(6)D. If any field test sample fails to pass, then the procedures outlined in that Section shall be applied.
6. Procedures for Destructive Test Failure - The following procedures shall apply whenever a sample fails the destructive test, whether performed by field or laboratory testing:
- a. The seam shall be reconstructed between any two (2) passed test locations, or
  - b. The seaming path can be traced to an intermediate location (at least ten (10) feet minimum from the location of the failed test in each direction) and a small sample taken for an additional field test at each location. If these additional samples pass the field tests, then full laboratory samples shall be taken. If these laboratory samples pass, then the seam shall be reconstructed between these locations. If either sample fails, then the process shall be repeated to establish the zone in which the seam should be reconstructed.
7. Acceptance of Seams - All acceptable seams must be bounded by two (2) locations from which samples passing laboratory destructive tests have been taken. In cases exceeding one hundred and fifty (150) feet of reconstructed seam, a sample taken from within the reconstruction zone must pass destructive testing. Whenever a sample fails, additional testing may be required for seams that were seamed by the same personnel and/or apparatus or seamed during the same time shift.

**9-35.2(7)E. Geomembrane Wrinkle.**

When seaming of a geomembrane liner is completed, or when seaming of a large area of a geomembrane liner is completed, and prior to placing overlying materials, the Engineer shall identify the location of excessive geomembrane wrinkles. Wrinkles so identified shall be cut, re-seamed and tested.

**9-35.2(7)F. Seams That Cannot Be Non-Destructively Tested**

The following procedures shall apply to locations where seams cannot be non-destructively tested:

1. All such seams shall be cap-stripped with the same geomembrane.
2. If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation.

**9-35.2(7)G. Engineering Observation.**

If the seam cannot be tested prior to final installation, the seaming and cap-stripping operations shall be observed by the Engineer and Contractor for uniformity and completeness.

**9-35.2(7)H. Geomembrane Acceptance.**

The Contractor shall retain ownership and responsibility for the geomembrane until acceptance by the Owner. The geomembrane shall be accepted by the Owner when:

1. Conformance test results meet the requirements of the Contract Documents.
2. Required documentation including warranty from the manufacturer, fabricator and installer has been received and accepted.
3. The installation is complete and accepted by the Engineer.
4. Verification of the adequacy of all field seams and repairs, including associated testing, is complete.
5. Written certification documents, including as-built drawings, have been received by the Engineer.

**9-35.3 Geosynthetic Clay Liner (GCL)****9-35.3(1) Acceptable Manufacturers**

Geosynthetic clay liner material shall be a sodium bentonite-geotextile composite material; "Bentomat " or "Claymax" as manufactured by Colloid Environmental Technologies Co., 1350 West Shure Drive, Arlington Heights, IL 60004, Telephone 847-577-5589; "Bentofix" as manufactured by National Seal Co., 1245 Corporate Boulevard, Suite 300, Aurora, IL 60504, Telephone 1-800-323-3820, or an approved equal.

Accessory bentonite to be used for placement along seams and around penetrations shall be pure, granular sodium bentonite.

### 9-35.3(2) Definitions Used In This Section

Geosynthetic Clay Liner (GCL). A manufactured hydraulic barrier consisting of clay bonded to a layer or layers of geosynthetics. The GCL may be reinforced or unreinforced as required by site conditions.

Geomembrane. An essentially impermeable geosynthetic composed of one or more geosynthetic sheets.

Geotextile. Any permeable textile used with foundation, soil, rock, earth, or any other geotechnical engineering related material as an integral part of a human-made project, structure or system.

Minimum Average Roll Value. The minimum average value of a particular physical property of a material, for 95 percent of all of the material in the lot.

Overlap. Where two adjacent GCL panels contact, the distance measuring perpendicular from the overlying edge of one panel to the underlying edge of the other.

### 9-35.3(3) Quality Assurance

1. **Manufacture's Qualifications:**  
The GCL manufacturer must have produced at least 10 million ft<sup>2</sup> of GCL, with at least 8 million square feet installed.
2. **Installer's Qualifications:**  
The GCL installer must either have installed at least 1 million ft<sup>2</sup> of GCL, or must provide to the Engineer satisfactory evidence, # through # similar experience in the installation of other types of geosynthetics, that the GCL will be installed in a competent, professional manner.
3. **Product Quality Documentation:**  
The GCL manufacturer shall provide the Engineer with manufacturing QA/QC certification for each shipment of GCL. The certifications shall be signed by a responsible party employed by the GCL manufacturer and shall include:
  - a. Certificates of analysis for the bentonite clay used in GCL production demonstrating compliance with the parameters swell index and fluid loss.

- b. Manufacturer's test data for finished GCL product(s) of bentonite mass/area, GCL tensile strength and GCL peel strength (if applicable) demonstrating compliance with the index parameters.
  - c. GCL lot and roll numbers supplied for the project (with corresponding shipping information).
  - d. Manufacturer's test data for finished GCL product(s) of GCL index flux, permeability and hydrated internal shear strength data demonstrating compliance with the performance parameters.
4. Quality Assurance by Owner.  
The Owner may engage the services of a Construction Quality Assurance Consultant (CQAC) for monitoring the quality and installation of material. The Contractor shall cooperate fully with supplemental testing performed by the CQAC and shall make available samples required for such testing.
5. Delivery, Storage and Handling
- a. Deliver GCL to the site only after the Engineer receives and approves the required submittals. Damaged or unacceptable material shall be immediately removed from the site and replace at no cost to the owner.
  - b. Prior to shipment, the GCL manufacturer shall label each roll, identifying:
    - 1) Product identification information (Manufacturer's name and address, brand name, product code).
    - 2) Lot number and roll number.
    - 3) Roll length and weight.
  - c. The GCL shall be wound around a rigid core whose diameter is sufficient to facilitate handling. The core is not necessarily intended to support the roll for lifting but should be sufficiently strong to prevent collapse during transit.
  - d. All rolls shall be labeled and bagged in packaging that is resistant to photodegradation by ultraviolet (UV) rays.
  - e. The manufacturer assumes responsibility for initial loading the GCL. Shipping will be the responsibility of the party paying the freight. Unloading, on-site handling and storage of the GCL are the responsibility of the Contractor, Installer or other designated party.
  - f. A visual inspection of each roll should be made during unloading to identify if any packaging has been damaged. Rolls with damaged packaging should be marked and set aside for further inspection. The packaging should be repaired prior to being placed in storage.
  - g. The party responsible for unloading the GCL should contact the manufacturer prior to shipment to ascertain the appropriateness of the proposed unloading methods and equipment.
  - h. Storage of the GCL rolls shall be the responsibility of the installer. A dedicated storage area shall be selected at the job site that is away from high traffic areas and is level, dry and well-drained.

- i. Rolls should be stored in a manner that prevents sliding or rolling from the stacks and may be accomplished by the use of chock blocks or by use of the dunnage shipped between rolls. Rolls should be stacked at a height no higher than that at which the lifting apparatus can be safely handled (typically no higher than four).
  - j. All stored GCL materials and the accessory bentonite must be covered with a plastic sheet or tarpaulin until their installation.
  - k. The integrity and legibility of the labels shall be preserved during storage.
6. **Warranty**
- a. The installer of the GCL to be used in the work shall warrant his workmanship to be free of defects for two (2) years after final acceptance of the work. This warranty shall include, but not be limited to, all seams, anchor trenches, GCL attachments to appurtenances, and penetration seals. The GCL installer shall also obtain and furnish the Owner a warranty from the GCL manufacturer for the materials used. The material warranty shall be for defects or failure due to weathering for 10 years, with temperatures ranging from (-) minus 30 degrees Fahrenheit to (+) plus 110 degrees Fahrenheit, after the completion of the work on a prorata basis.
  - b. Should a defect or failure occur within the aforesaid periods, the GCL installer shall bear all costs for repair and/or replacement of the GCL and shall in addition bear all costs for the excavation of any cover backfill that is required to be removed in order to repair and/or replace the GCL. All materials removed to allow repairs to be made shall be reinstalled by the GCL installer in accordance with these special provisions.

#### **9-35.3(4) Submittals**

Two copies of the following documents shall be submitted by the Contractor at least 3 weeks prior to the shipment of the GCL to the site.

1. Conceptual description of the proposed plan for placement of the GCL panels over the area of installation.
2. GCL manufacturer's MQC Plan for documenting compliance of these specifications.
3. A representative sample of the GCLs.
4. A project reference list for the GCL(s) consisting of the principal details for at least ten projects totaling at least 10 million square feet in size.
5. Upon shipment, the Contractor shall furnish the GCL manufacturer's Quality Assurance/Quality Control (QA/QC) certifications to verify that the materials supplied for the project are in accordance with the requirements of this specification.

**9-35-3(5) Materials**

1. The GCLs shall consist of a layer of natural sodium bentonite clay encapsulated between two nonwoven geotextiles and shall comply with all of the criteria listed in this specification.
2. Reinforced GCL shall be used on this project.
3. Acceptable GCL products are Bentomat™ ST, Bentomat™ DN, and Claymax™ 600SP, as manufactured by Colloid Environmental Technologies Co.; Bentofix as manufactured by National Seal Company.
4. The minimum acceptable dimensions of full-size GCL panels shall be 150 feet in length and 13.8 feet in width. Short rolls (those manufactured to a length greater than 70 feet but less than a full-length roll) may be supplied at a rate no greater than 3 per truckload or 3 rolls every 36,000 square of GCL, whichever is less.
5. A 12 -inch overlap guideline shall be imprinted on both edges of the upper geotextile component of the GCL as a means for providing quality assurance of the overlap dimension. Lines shall be printed in easily visible, non-toxic ink.
6. The granular bentonite or bentonite sealing compound used for seaming, penetration sealing and repairs shall be made from the same natural sodium bentonite as used in the GCL and shall be as recommended by the GCL manufacturer.

**9-35.3(6) Installation****9-35.3(6)A. Subgrade Preparation**

1. Any earthen surface upon which the GCL is installed shall be prepared and compacted in accordance with the project specifications and Plans. The surface shall be smooth, firm, and unyielding, and free of:
  - a. Vegetations.
  - b. Construction Debris.
  - c. Sticks.
  - d. Sharp rocks.
  - e. Void spaces.
  - f. Ice .
  - g. Abrupt elevations changes.
  - h. Standing water.
  - i. Cracks larger than one-quarter inch in width.
  - j. Any other foreign matter that could contact the GCL.
2. Subgrade surfaces consisting of granular soils or gravel may not be acceptable due to their large void fraction and puncture potential. Subgrade soils should possess a particle size distribution such that at least 80 percent of the soil is finer than a #60 sieve.



3. Immediately prior to GCL deployment, the subgrade shall be final-graded to fill in all voids or cracks and then smooth-rolled to provide the best practicable surface for the GCL. At completion of this activity, no wheel ruts, footprints or other irregularities shall exist in the subgrade. Furthermore, all protrusions, extending more than one-half inch from the surface shall either be removed, crushed or pushed into the surface with a smooth-drum compactor.
4. On a continuing basis, the project CQA inspector shall certify acceptance of the subgrade before GCL placement.
5. It shall be the installer's responsibility thereafter to indicate to the Engineer any change in the condition of the subgrade that could cause the subgrade to be out of compliance with any of the requirements listed in this Section.
6. At the top of sloped areas of the job site, an anchor trench for the GCL shall be excavated in accordance with the project plans. The trench shall be excavated and approved by the CQA Inspector prior to the GCL placement. No loose soil shall be allowed at the bottom of the trench and no sharp corners or protrusions shall exist anywhere within the trench.

#### **9-35.3(6)B. GCL Placement**

1. Reinforced GCL shall be placed on the sloped walls of the OCF cell.
2. GCL rolls should be delivered to the working area of the site in their original packaging. Immediately prior to deployment, the packaging should be carefully removed without damaging the GCL. The orientation of the GCL (i.e., which side faces up) should be in accordance with the Engineer's or manufacturer's recommendations. Unless otherwise specified, however, the GCL shall be installed such that the product name printed on one side of the GCL faces up.
3. Equipment which could damage the GCL shall not be allowed to travel directly on it. If the installation equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before placement continues.
4. Care must be taken to minimize the extent to which the GCL is dragged across the subgrade in order to avoid damage to the bottom surface of the GCL. A temporary geosynthetic subgrade covering commonly known as a skip sheet or rub sheet may be used to reduce friction damage during placement.
5. The GCL shall be placed so that seams are parallel to the direction of the slope. Seams should be located at least 3 feet from the toe and crest of slopes steeper than 4H:1V.
6. All GCL panels should lie flat on the underlying surface, with no wrinkles or fold, especially at the exposed edges of the panels.
7. Only as much GCL shall be deployed as can be covered at the end of the working day with soil, a geomembrane, or a temporary waterproof tarpaulin. The GCL shall not be left uncovered overnight. If the GCL is hydrated when no confining stress is present, it will be removed and replaced. The Engineers,

CQA inspector, and GCL supplier should be consulted for specific guidance if premature hydration occurs.

#### **9-35.3(6)C. Anchorage**

As directed by the Plans, the end of the GCL roll shall be placed in an anchor trench at the top of the slope. The front edge of the trench should be rounded so as to eliminate any sharp corners. Loose soil should be removed from the floor of the trench. The GCL should cover the entire trench floor and the rear trench wall.

#### **9-35.3(6)D. Seaming**

1. The GCL seams are constructed by overlapping their adjacent edges. Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris. Supplemental bentonite is required if the GCL has one or more non-woven needlepunched geotextiles.
2. The minimum dimension of the longitudinal overlap should be 12 inches. End-of-roll overlapped seams should be similarly constructed, but the minimum overlap should measure 24 inches.
3. Seams at the ends of the panels should be constructed such that they are shingled in the direction of the grade to prevent the potential for runoff flow to enter the overlap zone.
4. Bentonite-enhanced seams are constructed between the overlapping adjacent panels and described above. The underlying edge of the longitudinal overlap is exposed and then a continuous bead of granular sodium bentonite is applied along a zone defined by the edge of the underlying panel and the 12-inch line. A similar bead of granular sodium bentonite is applied at the end-of-roll overlap. The bentonite shall be applied at a minimum application rate of one quarter pound per lineal foot.

#### **9-35.3(6)E. Detail Work**

1. The GCL shall be sealed around penetrations and embedded structures embedded in accordance with the design drawings and the GCL manufacturer.
2. Cutting the GCL should be performed using a sharp utility knife. Frequent blade changes are recommended to avoid damage to the geotextile components of the GCL during the cutting process.

#### **9-35.3(6)F. Damage Repair**

If the GCL is damaged (torn, punctured, perforated, etc.) during installation, it may be possible to repair it by cutting a patch to fit over the damaged area. The patch shall be obtained from a new GCL roll and shall be cut to size such that a minimum overlap of 12 inches is achieved around all of the damaged area. Dry bentonite or bentonite mastic should be applied around the damaged area prior to placement of the patch. It

may be desirable to use an adhesive to affix the patch in place so that it is not displaced during cover placement.

#### **9-35.3(6)G. Cover Placement**

1. Cover soils shall be free of angular stones or other foreign matter which could damage the GCL. Cover soils should be approved by the Engineer with respect to particle size, uniformity, and chemical compatibility. Cover soils with high concentrations of calcium (e.g., limestone, dolomite) are not acceptable.
2. Soil cover shall be placed over the GCL using construction equipment that minimizes stresses on the GCL. A minimum thickness of 1 foot of cover should be maintained between the equipment tires/tracks and the GCL at all times during the covering process. This thickness recommendation does not apply to frequently trafficked areas or roadways, for which a minimum thickness of 2 feet is required.
3. Soil cover should be placed in a manner that prevents the soil from entering the GCL overlap zones. Cover soil shall be pushed up slopes, not down slopes to minimize tensile forces on the GCL.
4. Although direct vehicular contact with the GCL is to be avoided, lightweight, low ground pressure vehicles (such as 4-wheel all-terrain vehicles) may be used to facilitate the installation of any geosynthetic material placed over the GCL. The GCL supplier or CQA engineer should be contacted with specific recommendations on the appropriate procedures in this situation.
5. When a textured geomembrane is installed over the GCL, a temporary geosynthetic covering known as a slip sheet or rub sheet should be used to minimize friction during placement and to allow the textured geomembrane to be more easily moved into its final position.

#### **9-36 LEACHATE COLLECTION PUMPING SYSTEM - Add the following new section:**

All materials and equipment incorporated in the system shall be new, undamaged, of standard quality, and shall be subject to testing as specified.

##### **9-36.1 Pumps**

- A. The leachate detection collection pump shall be a Slanted Well Canister Pump with necessary controls, hoses, and water depth indicator, as manufactured by Clean Environment Equipment, 1133 Seventh Street, Oakland, CA 94607, Telephone 1-800-537-1767; or an approved equal.

- B. The temporary leachate collection pump shall be a Model 60520-4, single-phase, 230 V, 4 inch, submersible pump capable of pumping 50 gpm at a TDH of 80 feet, with liquid level controls, as manufactured by Grundfos Pumps Corporation, 3131 N. Business Park Avenue, Fresno, CA 93727, Telephone 1-800-333-1366; or an approved equal.

#### **9-36.2 Compressor**

The compressor shall consist of a Speedaire Cast Iron Series, Stock No. 72167, engine driven compressor (4 HP, single phase, 230 Volt, delivering 8.5 cfm at 100 psi, 30 gal. air tank) distributed and sold by W.W. Grainger, Inc., or an approved equal.

#### **9-36.3 Vault**

The air compressor equipment vault (Vault #1) shall be a 680-FC Containment Vault (8'L x 6'W x 7'H inside dimensions) as manufactured by Utility Vault Co., P.O.Box 610, Chandler, AR 85244, Telephone 602-963-2676, or an approved equal.

The leachate storage tank vault (Vault #2) shall be a 810-FC Containment Vault (10'L x 8'W x 7'H inside dimensions) as manufactured by Utility Vault Co, or an approved equal.

Vaults shall have cut outs for manway access riser, ventilation stack, and necessary conduits. Manway access riser shall be closed with a waterproof, locking access cover.

Vaults #1 and # 2 shall have the bottom interior section of the vault waterproofed with a slurry coat, as manufactured by XYPEX Chemical Corporation, 13731 Mayfield Place, Richmond, B.C., Canada V6V 2G9, Telephone 604-273-5265, or an approved equal. The waterproofing materials shall be applied in accordance with the manufacturer's specifications.

#### **9-36.4 Leachate Storage Tank**

The leachate storage tank shall be a fiberglass tank (5' diameter x 7'L) with a capacity of 1000 gallons. The tank will be fitted with floats to activate the alarm system when the tank contains 750 gallons and to deactivate the pump from the cell when the tank contains 950 gallons. The tank full shut-off shall be supplied by Clean Environmental Equipment or an approved equal and shall control both the pneumatic and submersible pumps.

##### **9-36.4(1) Submittals**

The Contractor shall submit a written assessment, reviewed and certified by an independent qualified registered professional engineer that the tank system has sufficient structural integrity and is acceptable for the storing and treating of hazardous waste as specified in 40 CFR Section 264.192(a).

The Contractor shall submit an inspection report from an independent, qualified installation inspector or independent qualified, registered professional engineer that the tank system is in accordance with 40 CFR Section 264.192(b).

### 9-36.5 Miscellaneous Leachate Collection Equipment

#### 9-36.5(1) Ventilation

Ventilator in Vault #1 shall be a 1/2 HP Fume Master Exhaust Fan as manufactured by Lab Safety Supply, P.O.Box 1368, Janesville, WI 53547, Telephone 800-543-9910, or an approved equal. The ventilator shall be rated at 345 cfm and provide a minimum of 30 air changes an hour. The ventilator in Vault #2 shall be a 1/2 HP Fume Master Exhaust Fan as manufactured by Lab Safety Supply, or an approved equal. The ventilator shall be rated at 360 cfm and provide at a minimum of 30 air changes per hour.

9-37 **PREFABRICATED VERTICAL DRAIN** – Not used.

9-38 **POLYPROPYLENE SUPERSACKS** - Add the following new section:

The following polypropylene "Supersack" shall consist of a heavy woven fabric having a minimum capacity of 3000 pounds. The bags shall have reinforced corners for maximized lifting capacity. Body seams shall have 4 ply stitching for strength.

#### 9-38.1 Acceptable Manufacturers

Polypropylene "Supersacks" shall be bulk bags as manufactured by Amoco Fabrics Company, Patchogue Plymouth Division, 550 Interstate North, Suite 150, Atlanta, Georgia 30099, Telephone (404) 955-0935, or an approved equal.

The bags shall meet specific dimensions and physical properties listed in Table 9-38-1.

**TABLE 9-38-1 POLYPROPYLENE SUPERSACK SPECIFICATIONS**

Property	Units	Value	Test Method
Tensile Strength (Warp/Fill)	Lbs.	275x275	ASTM D 4632
Trapezoid Tear Strength	Lbs.	120x120	ASTM D 4533
Burst Strength	PSI	600	ASTM D 3786
Puncture Strength	PSI	100	ASTM D 4833
Weight	oz/sq. yd.	6.5	ASTM D 1910
UV Resistance	% Strength Retained	>70	Federal Test Method 5804 Standard 191 A

9-39 **GEOGRIDS**

The geogrids shall consist of high strength, high molecular weight polyester geogrid. The geogrid shall be woven polyester fibers coated with polymer to provide dimensional stability.

**9-39.1 Acceptable Manufacturer's**

Geogrids shall be for soil reinforcement applications as manufactured by Mirafi, 365 South Holland Drive, Pendergrass, Georgia 30567, Telephone (706) 693-2226, or an approved equal.

Geogrids shall meet specific dimensions and physical properties listed in Table 9-39-1.

**TABLE 9-39-1 GEOGRID SPECIFICATIONS**

Property	Test Methods	24XT
Polymer (Coating)		PET (PVC)
Ultimate Wide With Tensile Strength (Lbs/Ft)	ASTM D 4595	25,380
Creep Reduce Strength (Lbs/Ft)	ASTM D 5262	14,756
long-term Design Strength (in sand, silt, clay) (Lbs/Ft)	GRI-GGK	12,195
Packaging		
Roll Width (Ft)		6.7
Roll Length* (Ft)		150
Estimated Roll Weight (Lbs)		281

**Note:** Standard roll lengths are shown; the products may be fabricated to greater lengths to met project needs.

## **9-40 ELECTRICAL GENERAL**

### **9-40.1.1 Definitions**

- A. The words "plans" and "drawings" are used interchangeably in this specification and in all cases shall be interpreted to mean "drawings".
- B. The word "provide" shall be interpreted to mean furnish and install.
- C. "Owner" shall be the contractor until the completion of construction and acceptance of the project at which time ownership shall be turned over to Asarco.
- D. "Contractor" is the party who furnishes and installs all tools, materials and equipment. This includes the Prime Contractor, the Electrical Contractor, Control System Integrator, and all other Contractors and Sub Contractors.
- E. "Control System Integrator" also referred to as the System Integrator or Integrator is the Party that furnishes all control components and designs the detailed control wiring diagrams plus the layout and assembly of the custom control panels.
- F. "Control System" includes all equipment, instruments and wiring for control and monitoring of all operating pumps and equipment. This includes custom control panels, motor control center, packaged control panels, and control equipment furnished with other systems and mechanical equipment. All sensing, transmitting, indicating, control and recording of all functions as specified and shown are also included in the control system.

### **9-40.1.2 General Description Of Work**

- A. The Contractor shall provide all labor, material, tools, equipment and services required to complete the furnishing, installation, wiring, connection, calibration,

adjustment, testing and operation of all electrical equipment, devices and components as indicated and implied by the plans and these specifications.

- B. Complete the wiring to, connection to, adjustment and calibration of, and testing of equipment having electric motors and/or built-in or furnished electrical components. Install electrical components that are furnished with mechanical equipment.
- C. Complete the procurement, installation, wiring, connection, calibration, adjustment, testing and operation of all electrical devices, components, accessories and equipment which is not shown or specified but which is nonetheless required to make the systems shown and specified function properly.
- D. The Contractor shall install and make all connections to the equipment furnished by the Owner.
- E. Provide the size, type and rating of motor control devices, equipment and wiring necessary to match the ratings of motors furnished with mechanical equipment.
- F. Provide adequate space for the electrical installation, including but not limited to, determination of access-ways and doorways, shipping sections, wall and floor space, and space occupied by mechanical equipment. Provide electrical equipment that fits in the areas shown on the drawings. All equipment shall be readily accessible for maintenance, shall have electrical clearances in accordance with NEC and shall be installed in locations which will provide adequate cooling.
- G. Check electrical equipment prior to installation so that defective equipment is not installed. Acceptance testing for electrical equipment shall be performed as discussed in Section 9-44.
- H. Provide start-up, follow-up and training of the owner's personnel for electrical systems. Make all corrective measures required during start-up. See specific requirements for training and start-up in other specification sections.
- I. Provide field services of qualified technicians to supervise and check out the installation of the equipment, to supervise and check out interconnecting wiring, to conduct start-up of operation of the equipment, and to correct any problems which occur during start-up.
- J. Provide circuit breakers, conduit, wire and installation for all items which require 120 VAC power.
- K. The motor control centers, transfer switches, RTU's, control panels, and instrumentation shall be supplied through the Control System Integrator.



### **9-40.1.3 Equipment Coordination**

- A. The Contractor is responsible to coordinate the equipment supplied from various manufacturers. This includes but is not limited to:
1. Obtaining specific information on equipment ratings and sizes and verifying the electrical components supplied meet, or match the requirements such as voltage, phase, frequency, starter types, etc.
  2. Verifying the equipment supplied will fit within the space allocated.
  3. Coordination of equipment and the electrical power and control requirements provided in all sections of the specifications and drawings.
  4. Providing power and control equipment, wiring, and raceways to meet the requirements of the mechanical equipment supplied.
  5. Providing all necessary control wiring and components for any special requirements from an equipment manufacturer.
- B. The Contractor shall verify as a minimum:
1. Correct voltage, phase and frequency
  2. Size and space requirements
  3. Mounting requirements
  4. Correct motor starter type
  5. Proper coordination with the controls and control system integrator.
- C. Any discrepancies between the electrical and other equipment shall be brought to the immediate attention of the Engineer.

### **9-40.1.4 Project Description**

- A. In general the project consists of providing power for leachate pumping and monitoring.
- B. The following statements highlight the main portion of the electrical work:
1. Coordinate with the local power utility and provide power service to the site.
  2. Power Vault #1 compressor, temporary pump, lighting and ventilation.
  3. Power Vault #2 lighting and ventilation and monitor tank.
  4. Monitor the tank level and vault flood conditions with an Alarm panel near Vault #2.

### **9-40.1.5 Temporary Operation And Construction Power**

#### **9-40.1.5.1 Facility Operation Power**

- A. If necessary, provide temporary power service for facility operation during construction. Provide power and control systems, circuits and components, and connections for all motors and equipment that remains in operation during construction. The Contractor shall pay for all coordination with the utility and associated construction costs for temporary facility power.
- B. Any necessary modifications to the existing electrical system for construction power shall be coordinated and paid for by the Contractor.
- C. The Owner shall pay for the energy costs as billed by the utility and these costs shall not be included in the Contractors bid price.

#### **9.40.1.5.2 Construction Power**

- A. If the existing service is adequate for facility operation and construction power, then the existing service may be used for construction power and the Owner shall pay all energy costs as billed by the utility on the existing meter.
- B. Any necessary modifications to the existing electrical system for construction power shall be coordinated and paid for by the Contractor.

#### **9-40.1.6 Nameplates**

- A. Nameplates shall be provided on all electrical devices, including but not limited to motor control equipment, MCC cubicles, control stations, junction boxes, panels, motors, instruments, switches, indicating lights, meters, and all electrical equipment enclosures.
- B. Nameplates shall also be provided on all electrical panel interior equipment, including but not limited to: relays, circuit breakers, power supplies, terminals, contractors, and other devices.
- C. Nameplates shall be made of 1/16" thick machine engraved laminated phenolic having black letters not less than 3/16" high on white background or as shown on the drawings or other sections of the Specifications. Nameplates on the interior of panels shall be White Polyester with printed thermal transfer lettering and permanent pressure sensitive acrylic; TYTON 822 or equal.
- D. All nameplates shall include the equipment name and number (and function, if applicable).
- E. Provide warning nameplates on all panels and equipment that contain multiple power sources. Lettering shall be white on red background.

- F. Nameplates shall be secured to equipment with stainless steel screws/fasteners. Epoxy glue may be used where fasteners are not practical if first approved by the Engineer.

#### **9-40.1.7 Thermal (Temperature) Ratings of Equipment Terminations**

- A. This section covers the temperature ratings of all electrical equipment terminations provided under this contract.
- B. All materials shall conform to the National Electrical Code Article 110-14C. Wiring and circuit breakers on this project are designed for 75°C operation above 30 amperes; 60°C for 30 amperes and below.
- C. All products furnished on this project shall have electrical terminations rated for 60°C for ampacities of 30 amperes or less and rated for 75°C for ampacities above 30 amperes.

#### **9-40.1.8 Standards And Codes**

- A. Permits, licenses, approvals and other arrangements for work shall be obtained and paid for by the Contractor and included in the bid price.
- B. Electrical work shall be executed in strict accordance with the latest edition of the National Electrical Code and local ordinances and regulations.
- C. All electrical equipment, materials, construction methods, tests and definitions shall be in strict conformity with the established standards of the following in their latest adopted revision:
1. Underwriters' Laboratories, Inc. (UL)
  2. National Electrical Manufacturers Association (NEMA)
  3. Canadian Standards Association (CSA)
  4. Electrical Testing Laboratories (ETL)
  5. Factory Mutual (FM)
- D. All materials and equipment specified herein shall, within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.
- E. All materials shall be new, free from defects, of current manufacture, and of quality specified or shown. Each type of material shall be of the same manufacturer throughout the work.

#### **9-40.1.9 Contract Documents**

- A. The electrical layouts are generally diagrammatic. The location of equipment is approximate unless dimensioned. Exact locations and routing of conduits shall be governed by structural conditions and physical interference and by locations of electrical terminations on equipment.

#### **9-40.1.10 Reference Documents**

- A. The Contractor shall refer to the drawings, project data and shop drawings of other trades for additional details, which affect the proper installation of the work.. Diagrams and symbols showing electrical connections are diagrammatic only, and so do not necessarily show the exact physical arrangement of the equipment.

#### **9-40.1.11 Site Familiarization**

- A. Before submitting a bid, the Electrical Contractor shall familiarize himself with all features of the site that may affect the execution of his work. The Contractor shall take all field measurements necessary for his work and shall assume full responsibility for their accuracy. The Contractor shall take full responsibility for locating and avoiding all substructures. Any damage to existing equipment shall be repaired or replaced by the Contractor at the Contractor's expense.

#### **9-40.1.12 Electrical Submittals**

- A. Electrical project data shall be submitted in accordance with the following:
1. Electrical submittals shall be submitted bound in a three -hole or ring binder, labeled with the project name and Contractor's name and an index sheet showing each product being submitted. Provide with section tabs per the electrical specifications by section and paragraph or equipment name, e.g., provide a minimum of one tab section for each piece of equipment in all of the Product Sections (e.g., 9-41.2.1, 9-42.2.1, etc.). Label each equipment submittal sheet with equipment name and number. Indicate location where each item of equipment submitted will be used on the job. Use equipment numbers when available.
  2. Submittals shall include the manufacturer's name, address, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference. Include other information necessary to establish contract compliance of each item proposed to furnish.
  3. The package of submittals shall be largely complete when first submitted. Long lead items may be submitted separately. Each item shall be clearly marked and provided with adequate sales and technical information to clearly show conformance with all aspects of the specification. Packages not

provided as described above or largely incomplete shall be returned to the Contractor without comment.

4. Control panels and control systems submittals may be provided separately, but must be followed in a timely manner as to allow coordinated review. Control submittals shall be provided with a Bill of Materials showing quantity, manufacturer's name, catalog number, and supplier name and phone number.
5. Certify on all submittals that the material being proposed conforms to the contract requirements. In the event of any variance, state specifically which portions vary and request a variance in writing.
6. Certify that all furnished equipment is able to be installed in the allocated spaces by stating on each item:
7. "This equipment will be able to be installed in the spaces allocated."
8. Shop Drawings shall be provided on 11" x 17" sheets maximum size, and shall be scaled using standard engineering or architectural scales. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment.
9. The Engineer will review the original submittal and one resubmittal on each item. Subsequent submittal reviews shall be conducted at the Contractor's expense; the Contractor shall be billed at the Engineer's current hourly rates.

#### **9-40.1.13 Storage And Installation Environment**

- A. All electrical equipment shall be stored in a dry environment free from dust, moisture, sprays or vapors, which may be detrimental to their new condition. After installation of equipment, care shall be taken to protect all equipment from all dust, moisture, paint and other spray, harmful vapors, etc. until final acceptance and certificates of occupancy have been obtained.
- B. Equipment shall not be installed in indoor areas until the area is covered, dry and finished to the point that other work will not create dust, vapors, or moisture. Equipment with integral heaters and fans shall not be installed until power is available at the location, and the heater and fan shall be energized within 6 hours of the equipment being installed.

#### **9-40.1.14 Final Acceptance**

- A. Prior to final acceptance the Engineer will perform one or more site observation trips to develop a "punch list" of items deemed incomplete. The Electrical Contractor and System Integrator shall be present while these inspections are

taking place and shall be available for opening cabinets and operating and adjusting the system as is necessary for the Engineer to verify all equipment is installed and operates to the requirements of the contract documents.

- B. Prior to the Contractor calling for this observation, the Contractor shall have completed all items of work, including wire markers, nameplates, final tests and final test reports. All equipment shall be checked for proper operation and all signals verified for correct calibration and wiring. Fixtures shall have been cleaned and burned out or defective lamps shall have been replaced.
- C. Final acceptance will not be given until:
  - 1. All work is complete
  - 2. All punch-lists are checked off and returned to the Engineer
  - 3. All test reports are received
  - 4. All O&M manuals are received
  - 5. All spare parts are received
  - 6. All instrument test forms are received
  - 7. All project record drawings are received.
- D. A punch list shall be prepared by the Engineer. Each punchlist item shall be completed by the Contractor and checked off of the list. When all of the items on the list are completed or commented on, the list shall be signed by the Contractor and returned to the Engineer for verification.

#### **9-40.1.15 Project Record Drawings**

- A. A set of drawings shall be maintained at the job site (by the Electrical Contractor) showing any deviations in the electrical systems from the original design.
- B. Another complete set of drawings shall be marked up in the office showing the changes made on the field set of drawings. All changes shall be clearly marked in red on the drawings. Drawings shall be submitted to the Engineer at the completion of the project.
- C. A set of electrical drawings marked in red to indicate the routing of conduit runs shall be submitted to the Engineer for review at the completion of conduit rough-in and prior to cover.

#### **9-40.1.16 Guarantee**

- A. The Contractor shall guarantee his work and all components thereof, excluding incandescent and fluorescent lamps for a period of 1 year from date of acceptance of the installation. He shall remedy any defects in workmanship and repair or

replace any faulty equipment which shall appear within the guarantee period without additional cost to the Owner.

#### **9-40.1.17 Cleanup**

- A. The premises must be kept free of accumulated materials, rubbish and debris at all times. Surplus material, tools and equipment must not be stored at the job site. At the completion of the job, all equipment and fixtures shall be left clean and in proper condition for their intended use.
- B. Lamps and fluorescent tubes shall be cleaned and defective units replaced at the time of final acceptance.

#### **9-40.1.18 Operation and Maintenance Manuals**

- A. The Contractor shall prepare and assemble detailed operation and maintenance manuals in accordance with the project general requirements and other requirements. The manuals shall be bound in a 3-ring binder and tabbed with an index. In general, the O&M manual format shall meet that of the submittal data in Section 9-40.1.12. The manuals shall include, but not be limited to, the following:
  - 1. Catalog data and complete parts list for all equipment and devices
  - 2. All cut sheets of equipment and components
  - 3. Preventative maintenance procedures
  - 4. Trouble-shooting
  - 5. Calibration
  - 6. Testing
  - 7. Replacement of components
  - 8. Automatic mode operation
  - 9. Manual mode operation
  - 10. System schematics/shop drawings and record drawings
  - 11. As-built wiring diagrams of cabinet and enclosure contained assemblies
  - 12. As-built wiring diagrams of overall system
  - 13. Listing of recommended spare parts
  - 14. Listing of recommended maintenance tools and equipment.

#### **9-40.1.19 Training**

- A. Training shall be provided per the specific requirements in other sections of these specifications. In addition to training required in other sections of the specifications, the Contractor shall conduct specifically organized training sessions in the overall operation and maintenance of the electrical system for personnel employed by the Owner. The training sessions shall be conducted to educate and train the personnel in operations and maintenance of all components

of the electrical system outside the training requirements in the other Sections. Training shall include, but not be limited to, the following:

1. Preventative maintenance procedures
  2. Trouble-shooting
  3. Calibration
  4. Testing
  5. Replacement of components
  6. Equipment operation
- B. At least two (2) training sessions, each at least two (2) hours in duration, shall be conducted at the facility after start-up of the system. The Contractor shall prepare and assemble specific instruction materials for each training session and shall supply such materials to the Owner at least 2 weeks prior to the time of the training.

#### **9.41 OVERCURRENT PROTECTIVE DEVICES**

##### **9-41.1.1 Description of Work**

- A. This section covers the furnishing and installation of all fuses and circuit breakers used in this project.

##### **9-41.1.2 Standards and Codes**

- A. All materials and equipment specified herein shall, within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.
- B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.
- C. All materials and equipment specified herein and their installation methods shall conform to the latest published version of the National Electric Code (N.E.C.).
- D. All materials shall conform to the National Electrical Code Article 110-14C. Wiring and circuit breakers on this project are designed for 75°C operation above 30 amperes; 65°C for 30 amperes and below.

##### **9-41.1.3 Submittals**

- A. In accordance to the submittal requirements in Section 9.40.1.12, submit catalog data showing material information and conformance with specifications. The intended use of each item shall be indicated.



**9-41.2.1 Fuses**

- A. Fuses shall be of the type and amperage indicated on the drawings. The voltage rating shall be appropriate for the application indicated. The fuse types indicated on the drawings imply a certain set of fuse characteristics. No substitutions of fuse types will be allowed without written approval from the Engineer.
- B. All fuses used on the project shall be provided with "blown fuse" indicators.
- C. Where fuses in motor circuits are indicated but not sized, provide Manufacturer's recommended fuse size based on actual motor installed.
- D. Provide in-line or integrally-mounted fuse clips on control power or low-voltage transformer.
- E. Provide fuse puller or pullers for fuse sizes used.
- F. Provide surface mounted cabinet sized to store required spare fuses at location coordinated with Owners Representative.
- G. Provide a minimum of two spare fuses for each fuse used.
- H. Acceptable Manufacturers:
  - 1. BUSSMAN
  - 2. GOULD SHAWMUT
  - 3. LITTLEFUSE
  - 4. RELIANCE

**9-41.2.2 Molded Case Circuit Breakers**

- A. Molded case circuit breakers shall be quick-make and quick-break type. They shall have wiping type contacts. Each shall be provided with arc chutes and individual trip mechanisms on each pole consisting of both thermal and magnetic trip elements. Two and three pole breakers shall be common trip. All breakers shall be calibrated for operation in an ambient temperature of 40°C. Molded case circuit breakers shall be trip-free. Each breaker shall have trip indication independent of the ON or OFF positions.
- B. Breakers shall have lugs UL listed for both copper and aluminum.
- C. Circuit breakers shall be capable of accepting the cable shown on the drawings. Circuit breakers not capable of accepting the cable shown shall not be acceptable.

- D. Breakers shall have the interrupting rating and trip rating indicated on the drawings.

#### **9-41.2.3 Uses**

- A. Breakers covered under this specification may be installed in switchboards, panelboards, motor control centers, combination motor starters and individual enclosures.

#### **9-41.2.4 Enclosures**

- A. Unless otherwise shown on the drawings; enclosures for protective devices shall be NEMA rated for the environment in which they are installed. In general, devices installed indoors shall be in NEMA 12 enclosures, devices installed outdoors shall be in NEMA 4X enclosures.

#### **9-41.3.1 Installation**

- A. Fuses and circuit breakers shall be installed in their respective enclosures and locations in such a manner as to ensure tight connections to preclude arcing and overheating.

### **9.42 SERVICE AND METERING**

#### **9-42.1.1 Description of Work**

- A. Work consists of installation of new 100 amp 230/115V, 1Ø underground service, service transfer and service entrance equipment.

#### **9-42.1.2 Scheduling Work with the Utility Company**

- A. The Contractor shall be fully and completely responsible for all scheduling and coordination with the utility company. The Contractor shall coordinate and schedule power outages, power service for operation and construction, and power service as may be required by the facility prior to Certificate of Occupancy.
- B. The Contractor shall make all necessary applications for service with the utility, and shall notify the Owner in writing of any obligations that the Owner must fulfill for service to be started, installed, or modified.

#### **9-42.1.3 Contractor/Utility Interface Responsibilities**

- A. The electrical utility providing service to these facilities is Tacoma Public Utilities (TPU).

- B. During design, contact was made with Terry Caillier of TPU at (253) 502-8436. The division of responsibilities stated below has been determined by coordination with the utility. The Contractor shall comply with all utility company standards and requirements.
- C. All utility company charges for and related to the final permanent service to the facility will be paid by the Owner, directly to the utility company and shall not be included in the Contractor's bid price.
- D. Any and all modifications to the service or power system at the facility shall be paid for by the Contractor.
- E. The Contractor shall notify the Owner in writing of any obligations or forms that the owner is responsible to provide for service.

#### **9.42.1.3.2 The Contractor Shall**

- A. Provide trenching, backfill and borrow material for the primary extension.
- B. Provide trenching, backfill and borrow material for the secondary service.
- C. Provide the transformer vault.
- D. Provide underground secondary conduit and wiring, from the Utility Company transformer to the metering. Provide sufficient conductor to reach and connect to the transformer secondary terminals.
- E. Provide the meter enclosure.

#### **9.42.1.3.2 The Utility Company Will**

- A. Provide and install primary conductors in the contractor excavated areas.
- B. Provide new service transformer and terminate primary and secondary conductors.
- C. Provide and install meter in Contractor supplied enclosure.

#### **9.42.1.4 Quality Assurance**

- A. Comply with all serving utility company standards and requirements.

#### **9-42.1.5 Standards and Codes**

- A. Work involving service installation shall be done in accordance with the serving utility's standards and the National Electric Code.

- B. Service equipment shall be listed and labeled by UL as "suitable for use as service equipment".

#### **9-42.1.6 Submittals**

- A. In conformance with the submittal requirements of Section 9-40, submit catalog data showing material information and conformance with specifications on the following:
  - 1. Prior to submittal to the Engineer, the Contractor shall submit all equipment and construction details (such as size, mounting height, location of equipment, etc.) to the serving utility for verification of compliance to the utility's requirements.
    - a. Meter Enclosure
    - b. Service Entrance Breaker
    - c. Surge Arrestors

#### **9-42.2.1 Meter Enclosure**

- A. Meter enclosure shall be Circle AW and as required to meet the requirements of the serving utility. Installation shall be in vandal proof NEMA 3R enclosure with a lockable hinged door.
- B. Contractor shall coordinate with Utility Company on type of metering required and shall provide all labor and material necessary to meet Utility Company requirements.

#### **9.42.2.2 Service Entrance Breaker**

- A. Service entrance shall be outdoor NEMA 3R construction and shall contain the circuit breaker, neutral and ground buses. Service equipment shall meet the requirements of the serving utility and shall be suitable for use as service equipment.

#### **9-42.2.3 Surge Arrestors**

- A. Provide Surge arrestors , with indicators, where shown on the one-line diagrams to protect against overvoltage transients (JOSLYN J9200 series with protective capacitor GE model 9L18 or equal). Select proper components for the application as shown on the drawings.

**9-42.3.1 Ground Electrode System**

- A. The grounded conductor and ground bus shall be connected to the grounding electrode system via the grounding electrode conductor as indicated on system one-line diagram.
- B. The system shall be as indicated in Article 250-81 of the National Electrical Code.

**9.42.3.2 Underground Secondary Service**

- A. Install in accordance with the Plan and Utility Company requirements.

**9-42.3.3 Utility Requirement Verification**

- A. The Contractor shall coordinate and submit all equipment, materials, etc. related to the utility work to the serving utility to verify conformance to the Utility's requirements for service. The Contractor shall also submit any plans for the installation of the primary and secondary service for approval by the Utility prior to excavation. Any discrepancy between the Utility requirements and the Contract documents shall be brought to the immediate attention of the Engineer.

**9.43 PANEL BOARDS****9-43.1.1 Description of Work**

- A. This section covers the furnishing and installation of all panelboard equipment complete.

**9-43.1.2 Standards and Codes**

- A. All materials and equipment specified herein shall, within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.
- B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.
- C. All materials and equipment specified herein and their installation methods shall conform to the latest published version of the National Electric Code (N.E.C.).

**9-43.1.3 Submittals**

- A. Submit catalog data showing material information and conformance with specifications. The intended use of each item shall be indicated.

**9-43.2.1 Panelboard Type**

- A. Panelboards shall be rated at proper voltage and current for intended use with bus bars of aluminum. Panels shall have phases, voltage and current ratings as shown on the drawings. Panels shall have 100 percent neutral, with equipment ground bar, unless noted otherwise. Panelboards shall be dead front.
- B. Panels shall have as a minimum the number of circuits shown on the panel schedules on the drawings.

**9-43.2.2 Circuit Breakers**

- A. The following interrupting capacity shall be considered minimum. Other ratings shall be as specified on the drawings.
- B. 240V and 208Y/120V Panelboards    10,000 AIC symmetrical
- C. Mount breakers in all panelboards so that breaker handles operate in a horizontal plane. Bolt-type only. Provide common trip on all multiple pole breakers.
- D. Where noted, provide spare breakers, complete for future connection of wiring circuits. Where "Space Only" is indicated for breakers, provide all bussing and breaker mounting hardware in the panelboard; provide steel knockouts in dead front metal closure of unused part of panel. If any steel knockouts are removed, provide breakers in such spaces or approved cover plates. Open spaces are not permitted.

**9-43.2.3 Cabinet for Each Panelboard**

- A. Cabinet shall be flush or surfaced as indicated, with tight closing doors without play when latched. Where two cabinets are located adjacent to each other in finished areas, provide matching trim of the same height.
- B. Provide cabinets of sufficient dimensions to allow for future expansion and addition of circuit breakers within the panelboards as indicated on drawings.
- C. Provide lock for each cabinet door. All electrical distribution equipment locks shall be keyed identically.
- D. Fasten panelboard with machine screws with oval countersunk heads, finish hardware quality, with escutcheons or approved trim clamps. Clamps accessible only when dead front door is open are acceptable. Surface mounted panelboards with fronts greater than 48 inches vertical dimension shall have trim hinged at right side in addition to hinged door over dead front.

- E. Provide factory standard lacquer or enamel finish, ASA #49 gray.

#### **9-43.2.4 System of Numbering and Bus Arrangement**

- A. Shall be as shown on the Panel Schedules on the drawings.
- B. Provide a type written circuit directory card for each panelboard with the load name, number, location and kVA.

#### **9-43.2.5 Panelboard Nameplate**

- A. Provide engraved (color layer - engraved through outer layer) plastic name plate with 1/2 inch high characters for panel identification (for panel name); attached with stainless steel screws to each panelboard front. Emergency system - white on red; Normal system - black letters on white. Include voltage, phase and wire (i.e., 208Y/120V, 3 phase, 4 wire ) in 3/8 inch characters.

#### **9-43.3.1 Mounting**

- A. Secure in place with top of cabinet at 6' - 6", unless otherwise noted. Top of cabinet and trim shall be level.

#### **9-43.3.2 Circuit Index**

- A. For each branch circuit panelboard provide neatly type written, as-built information for each panelboard by circuit with its proper load designation. Mount the panelboard circuit directory inside the door of each panelboard in a clear plastic sleeve. Provide one spare blank card for each card used.

#### **9-43.3.3 Dead Front Closures**

- A. Close all openings in dead front with closures manufactured for the purpose or install spare breakers.

### **9.44 ALARM PANEL & STARTER**

#### **9-44.1.1 Description of Work**

- A. Work and materials specified in this section include the telemetry equipment for monitoring the pumps and tank level in the vaults and provide the starter for the temporary pump.

#### **9-44.1.2 Control System Integrator**

- A. The Control System Integrator shall be solely and completely responsible for the final design and assembly of the entire control system and the power and control panel. The system shall be designed to provide the control capabilities and

functions indicated and implied by the plans and these specifications and to provide trouble-free operation with minimum maintenance. The system shall readily enable manual operation of any and all functions in the event of failure of any one component.

- B. The Control System Integrator shall be selected by the Contractor from the following acceptable companies:
1. Custom Controls Corporation – Fife, Washington
  2. Superior Custom Controls - Seattle Washington

#### **9-44.1.3 Responsibility of Contractor & Control System Integrator**

- A. The manufacturer of the power and control panel shall be fully and completely responsible for the design and assembly of the system as specified herein and shall be enjoined by the Contractor as a subcontractor. The assignment of specific responsibilities herein to the manufacturer shall not, in any way and under any conditions, diminish or usurp the Contractor's full and complete responsibility for all work performed and all materials installed under the contract. The contract between the Contractor and the manufacturer shall specifically require that the manufacturer conform to and meet all requirements specified herein.

#### **9-44.1.4 Standards and Codes**

- A. All equipment and materials shall conform to the latest revised editions of applicable standards published by the following organizations:
1. American National Standards Institute (ANSI)
  2. Institute of Electrical and Electronic Engineers (IEEE)
  3. National Electrical Manufacturers Association (NEMA)
  4. Underwriters' Laboratories (U/L)
  5. Instrument Society of America (ISA)
  6. National Fire Protection Association (NFPA 20)
- B. All electrical equipment and materials, and the design, construction, installation, and application thereof shall comply with all applicable provisions of the National Electrical Code (NEC), the Occupational Safety and Health Act (OSHA), and any applicable federal, state, and local ordinances, rules and regulations.
- C. All materials and equipment specified herein shall, within the scope of UL examination services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.
- D. All control panels shall bear a label by an approved testing authority for the completed assembled panel.

#### **9-44.1.5 Integration With Telemetry**



- A. The manufacturer of the alarm panel shall determine all requirements for the alarm system and shall include in the panel all required devices and equipment for interfacing contact closures.

#### 9-44.1.6 Shop Drawings

- A. The Control System Integrator shall develop all shop drawings required for design, fabrication, assembly and installation of the control system. Shop drawings shall include all drawings required in manufacture of specialized components and for assembly and installation of them. Shop drawings shall be CAD drawn and include the following:
1. System schematic diagrams for the entire control system including but not limited to: all sensors, control panels, motor control center and motor control equipment; with all components and their locations indicated. Wire and terminal numbers shall be included on the schematic diagrams.
  2. Technical data sheets for all components with the complete part number of the component clearly designated with all required options.
  3. Arrangement drawings of all panel front- and internal-mounted instruments, switches, devices, and equipment indicated. Show all panel mounting details required. Include outer dimensions of all panels on the drawing. Deviations from approved arrangements require resubmittal and approval prior to installation.
  4. Arrangement drawings shall be drawn to scale using standard Architectural or Engineering scales.
  5. Detailed dimensional drawings of the installation of all sensors (level, pressure, flow, valve position, motion, etc.) and of mounting brackets and other devices required for installation of sensors.
  6. Shop drawings shall be provided on sheets no larger than 11" x 17". Shop drawings shall include specific product detail such as rating, size, and number of contacts, etc. Wiring diagrams shall be included for all components in the system including control equipment supplied with mechanical devices.
  7. Wiring diagrams shall:
    - a) Have a minimum of one sheet per each motor controller, or subsystem.
    - b) Include wiring diagrams for packaged control panels and other related control equipment supplied with mechanical systems.
    - c) Include instrument loop diagrams.
    - d) Include for all motor control wiring diagrams, both the motor power and control wiring in the MCC bucket and other related control wiring for the motor on the same sheet at the end of this section.
    - e) Include details of individual PLC input and output cards with card wiring, base, slot, input, output, terminal, and device identification.
    - f) Provide wire and terminal numbering.
  8. For shop drawing packages which include more than 10 sheets provide the drawings in a separate 11" x 17" binder with an index for the drawings at the front.

- B. Installation details shall include the size, number, type and location of interconnecting wiring and conduit, installation of cabinets and enclosures, installation of sensors, instruments, limit switches, and other installation requirements. Shop drawings shall be submitted to the Contractor for review and approval. After approval by the Contractor, copies of all shop drawings shall be submitted to the Engineer.

#### **9-44.1.7 Submittals**

- A. In accordance with the requirements of Section 9-36 and other related sections of this specification, the Control System Integrator shall develop and shall submit to the Engineer, through the Contractor, the following project data:
1. All shop drawings.
  2. Descriptive text on wire markers to be used.
  3. Cut sheets for all products with a Bill of materials showing quantity, manufacturer, catalog number, and the supplier name and phone number. Relate the bill of materials to the submitted product index.
- B. The Contractor shall review all shop drawings prior to submittal to the Engineer. The Contractor's review shall include:
1. Coordination of wire routing on the wiring diagrams and the raceway system.
  2. Equipment shall be checked for layout and size for coordination and verification that equipment will fit within the space designated.
  3. Coordinate with panel wire entrances and interior wireways and space (size and location) for field connections.
  4. Coordination of equipment mounting and installation.

#### **9-44.1.8 Warranty**

- A. In accordance with the requirements of Section 9.40 1.16, the Contractor shall guarantee the control system to be free of defects in design, materials and workmanship for a period of one (1) year following the date of acceptance, by formal action of the Owner, of all work under the contract.
- B. As part of the guarantee, the Contractor and the manufacturer of the power and control panel shall indemnify and hold harmless the Owner, the Engineer and their officers, agents and employees against and from all claims and liability arising from all damage and injury due to defects in the control system.
- C. The Contractor shall cause the manufacturer of the power and control panel to make any and all repairs, replacements, modifications and adjustments within three days of notification. Should the manufacturer fail to begin the work within two days or complete the work within three days, the Owner may proceed to undertake or complete the work. In such event, the Contractor and his surety shall be liable for all costs incurred by the owner.

#### **9-44.1.9 Operation and Maintenance Data**

- A. The manufacturer of the power and control panel shall prepare and assemble detailed operation and maintenance manuals in accordance with the requirements of section 9.40 1.12. The manuals shall include, but not limited to the following:
1. Preventative maintenance procedures
  2. Trouble-shooting
  3. Calibration
  4. Testing
  5. Replacement of components
  6. Automatic mode operation
  7. Manual mode operation
  8. System schematics
  9. As-built wiring diagrams
  10. Catalog data and complete parts list for all equipment and control devices
  11. Listing of recommended spare parts
  12. Listing of recommended maintenance tools and equipment

#### **9-44.1.10 Coordination With Motor Control and Other Equipment**

- A. The Control System Integrator shall be solely and completely responsible for coordination and integration of control system with the motor control and other related equipment. The Control System Integrator shall communicate directly with the manufacturer(s) and supplier(s) of all related control equipment to determine all intended details of the equipment which may influence or affect the control system. The Control System Integrator shall determine all requirements for and shall cause integration of the control system and all other control equipment into a unified operating system. The Control System Integrator shall define all requirements for all interfacing equipment and shall supply all appurtenances, accessories and all such devices which may be required for proper interfacing as part of the control system.
- B. The Integrator shall be responsible to obtain submittal information on equipment supplied by other disciplines and to integrate them into the control system to form a complete working package as outlined by the contract documents. This includes but is not limited to a pneumatic pump.

#### **9-44.2.1 Products General**

#### **9-44.2.2 Design and Assembly**

- A. All equipment and materials utilized in the system shall be the products of reputable, experienced manufacturers with at least five (5) years experience in the manufacture of similar equipment. Similar items in the system shall be the

products of the same manufacturer. All equipment shall be of industrial grade and of standard construction, shall be capable of long, reliable, trouble-free service, and shall be specifically intended for control and monitoring of operation of motor-driven pumps and equipment. All equipment shall be of modular design to facilitate interchangeability of parts and to assure ease of servicing. All equipment, where practical, shall be of solid state, integrated circuit design.

- B. The system shall be completely assembled in the shop by the Control System Integrator. All components and equipment shall be prewired to the maximum extent possible.
- C. All components, including both internally and face-mounted instruments and devices, shall be clearly identified with phenolic nameplates of white background with black letters. Nameplates on the interior of panels shall be White Polyester with printed thermal transfer lettering and permanent pressure sensitive acrylic; TYTON 822 or equal.

#### **9-44.2.3 Interconnecting Wiring/terminals**

- A. The Control System Integrator shall determine all requirements for field-installed interconnecting wiring between control system components, sensors, pumps and equipment. The Control System Integrator shall determine the number, size, and type of wires and the number, size, type, and location of conduits and wireways.
- B. The wire and conduit shown on the plans shall be considered only as general guidelines for signal and control circuits. The Control System Integrator shall determine all specific requirements and shall confirm or modify the wiring and conduit shown on the plans to conform to such requirements.
- C. All interconnecting wires installed by the manufacturer and installer shall be numbered at each end using custom pre-printed heat shrink sleeve markers. Markers shall be T&B, SHRINK-KON HVM or approved equal. Terminations shall be made using solderless pressure connectors at all terminations. All conductors shall be stranded wire with thermoplastic insulation and shall be cabled to groups and supported so as to prevent breaking and to present an orderly arrangement and neat appearance. All outgoing wiring shall be terminated on a marked terminal strip capable of connection of at least 2 No. 14 wires and all terminal connections shall be numbered consecutively throughout the system.
- D. Provide 5 spare terminals in each enclosure that has terminals or 10% whichever is the greater amount. In addition, provide extra din rail with enough space for 20% more terminals.
- E. For all energized circuits (power and control) powered from the panel and extend outside of the panel provide an individual fused terminal with appropriate fuse and "blown fuse" indicator light for each circuit.

- F. For all energized circuits powered outside of the panel which extend into the panel, provide a disconnecting terminal to isolate each individual circuit with indicator light to show the circuit is energized.
- G. In general all control wiring shall be #14 AWG except PLC I/O wiring between the PLC cards and the terminal strips within the same cabinet shall be #18 AWG.
- H. Provide wire ways as necessary in the enclosure to contain all internal wiring and all field wiring. Size wireways such that there is ample room for the wiring required by this contract. Wireways shall be filled to a maximum of 70% to allow 30% more future wire.
- I. Low voltage DC control and signal conductors shall be bundled separately from alternating current circuits. Separate raceways and wire gutters shall be dedicated for AC and DC wiring, and labeled as such on the shop drawings. Wiring may cross at right angles if necessary. Special caution shall be used for PLC I/O card wiring and field terminations to accommodate the separation of AC and DC circuits. Intrinsically safe wiring shall be physically separated from non intrinsically safe wiring.
- J. All wiring shall be neatly tied in position with nylon cable ties. Instruments with portable cord connections shall be fed through the instrument panel plug strip which shall be located near the top of the panel directly above the instruments. Instrument supply cords shall be the only panel wiring which is not continuously supported and tied.
- K. All wiring and tubing crossing hinges shall be installed in a manner to prevent chafing. Bundles of similar conductors shall be clamped securely to the door and to the panel, and the bundles shall run parallel to the hinge for at least 12 inches. Spiral nylon cable wrap shall be provided in the hinge section of the bundle to fully protect the conductors or tubing against chafing.

#### **9-44.2.4 Motor Starter Units/Contactors**

##### **9-44.2.4.1 General**

- A. Motor starter units shall be of the combination type with components as indicated on the drawings. Magnetic contactors shall be heavy duty NEMA rated, SQUARE-D type S, ALLEN BRADLEY Bulletin 509, FURNAS INNOVA, CUTLER HAMMER FREEDOM, or equal. All contactors shall be provided with two field convertible auxiliary contacts. An auxiliary switch shall be provided to indicate the circuit breaker is in the "ON" position. Switch shall be open when the circuit breaker is open. Motor starters and associated equipment shall be provided to match the load being served.

#### **9-44.2.4.2 Overload Relays**

- A. Thermal overload relays on starters shall be non-ambient compensated bimetallic type or solid state type with selector for either auto or manual reset. Overload Relays shall monitor all energized conductors. A Separate normally open overload contact shall be provided in addition to standard normally closed overload contact. Overload relay shall be provided with a circuit test button which shall simulate an overload trip, trip indication, and reset pushbutton. Overload which trip on phase fail shall automatically reset upon normal power restoration.

#### **9-44.2.4.3 Transient Suppressors**

- A. Provide all contactor coils with transient suppressors to limit the high voltage transients produced when power is removed from the coil (CUTLER HAMMER - C320AS1 or equal).

#### **9-44.2.4.4 Double Enclosures for Outdoor Areas**

- A. The exterior panel shall be NEMA 3R made of aluminum (.125" thick minimum) with double flanged door frame on all four sides. All exterior seams shall be continuously welded or sealed. Provide enclosure with louver vents, vent fan and thermostat. Exterior enclosure shall be Hennessy Products, Inc. freestanding enclosure or equal with minimum size as shown on drawings.
- B. The interior enclosure shall be NEMA 12 aluminum construction equal to Hennessy Products, Inc. standards and quality of manufacture. Enclosure sizes shall be a minimum of that shown on the drawings. Provide inner enclosure with vents, heater, and thermostat. Provide outer enclosure with vents, fan and thermostat.

#### **9-44.2.4.5 Enclosure Door Latches**

- A. Door latches shall be fast operating type 3-point latch door handle; or where a 3-point latch will not meet rating requirements use fast operating clamp assemblies (maximum of two latches per enclosure). Hoffman Bulletin A-80. The latch handle shall operate toward the center of the panel to open the door, and be pointing down when closed and locked. All outdoor cabinets shall be lockable.

#### **9-44.2.4.6 Wireways**

- A. Provide molded plastic wireways, slotted for wire connections for all wiring in the panels. They shall be complete with covers. Wireways shall be manufactured by Panduit or Taylor.

#### **9-44.2.4.7 Terminals**

- A. Provide terminals for all wire connections to field wiring and internal power distribution. Analog loops that are 24 VDC powered shall have a knife switch to disable the loop if necessary. Connections shall have box type lugs capable of terminating 2 #14 AWG stranded wires. Terminals shall be strip mounted as manufactured by Entrelec or Phoenix Contact.
- B. Fuse terminal blocks shall be hinged disconnect level type with "blown fuse" indicators. PHOENIX CONTACT UK 5 series or equal.
- C. Disconnecting terminal blocks shall be knife type with light indicator PHOENIX CONTACT type MTK or equal.
- D. Provide 1 spare, or 3% whichever is the greater amount, spare (non installed) replacement terminals for each type used.

#### **9-44.2.4.8 Strip Heater**

- A. Provide a 100 watt (or as shown on the plans) resistance heater with 120 VAC line thermostat in each control enclosure located outdoors or in moist environments. The thermostat shall be adjustable between 50°F. and 80°F.

#### **9-44.2.5 Operator Interface Devices**

##### **9-44.2.5.1 General**

- A. All operator interface devices mounted on the panel front shall be rated for the environment in which they will be located. In general, devices mounted on indoor panels shall be NEMA 13 rated. Operator devices mounted outdoors, or in wet or corrosive environments shall be NEMA 4X rated.

##### **9-44.2.5.2 Elapsed Time Meters**

- A. Elapsed Time Meters (ETM) or run time (RTM) on control panels shall be 1-1/2" x 3/4" nominal size, case type for flush panel mounting. The meter face shall be of the style that most closely resembles the indicating instruments and shall have black trim with white or aluminized face. The meters shall have a 6-digit non-reset register with the last digit indicating tenths of an hour (Veeder-Root or equal).

##### **9-44.2.5.3 Selector Switches**

- A. Selector switches shall be NEMA 13, or NEMA 4X as required by mounting location. Selector switches shall be 2, 3, or 4 position as required by the

application. Selector switches installed outdoors shall have knob lever operator handle. Selector switches installed indoors shall have standard knob operator. Units shall be heavy duty type, Allen-Bradley 800H or 800T, G.E. Series CR104P or equal.

#### **9-44.2.5.4 Outdoor Alarm Beacon**

- A. The outdoor alarm beacon shall be 120V powered flashing high intensity strobe light with double fresnel lens. Beacon shall have no moving parts, transistorized power supply and xenon flash tube flashing a 360 degree beam through a shatter resistant Lexan optic lens. Triggering and timing circuits shall be integral parts of the power supply (Edwards Model 90 or approved equal). Provide interposing relay for interface with the PLC.

#### **9-44.2.6 Relays**

##### **9-44.2.6.1 Relays for General Purpose**

- A. Relays for general purpose use shall have, 10 Amp contacts with the appropriate coil voltage for the application. All relays shall have an integral indicating light to show if there is coil voltage present. They shall have an 8-pin/blade base and matching socket. Units shall be Allen-Bradley 700 type HA, HB, Idéc RH Series, or equal. Appropriate relay shall be selected based on application from the control wiring diagrams.

##### **9-44.2.6.2 Time Delay Relays**

- A. Time delay relays shall be multi-function, multi-range with plug-in base ,pin style terminations, timing and timed out LED indicators, and calibrated scales. Relays shall have minimum 0.5 seconds to 60 minutes, 8 selectable timing ranges, 5 amp contacts. Select coil voltage for the application. Minimum accuracy requirements (plus or minus) shall be as follows: 1) Repeat accuracy 1/2% 2) Timing change over full voltage range 1/2% change over full temperature range 2% 3) Scale tolerance 5%. Allen-Bradley Bulletin 700 type HR series; IDEC, GT3A or equal. Appropriate relay shall be selected based on application from the control wiring diagrams.

#### **9.44.2.7 Control Sensors**

##### **9-44.2.7.1 Drywell Liquid Level Switches (Flood Switch)**

- A. Provide drywell liquid level switch, hermetically sealed, magnetically actuated, snap action, 15W, 120V SPST, N.C. (dry). TRANSAMERICA DELAVAL - GEMS LS-1900 or 1950 chosen for the environment or approved equal.



- A. Provide a submersible level sensor for leachate level control of the temporary pump.
- B. The level sensor shall be a submersible level transmitter, suitable for leachate immersion, constructed of titanium and suitable plastics that shall be 24Vdc loop-powered with a 4-20mA output. Range will be a minimum of 0-20 feet above the pump level. Provide cord for full length of underground pipe and back to the current monitor relay. Sensor shall be Druck PTX/PMP 1230 or equal. Provide a terminal enclosure for venting and termination. Druck STE 100 or equal.
- C. Provide a 24VDC power supply.
- D. Provide a current monitor relay to monitor the 4-20 mA level signal and provide a contact closure on adjustable high level and contact opening at an individually adjustable low level. Adjust the relay to span the owner's requested range within 0-30 feet above the sensor. The current monitor relay shall have indicating lights for low and high levels. Relay shall be Entrelec SRS or equal.
- E. Provide the CMR in a Mena 12 enclosure adjacent to the pump starter.

#### **9.44.2.8 Alarm Panel (RTU)**

- A. The equipment shall be a remote telemetry unit suitable for communication over a twisted shielded pair. It shall operate at both 12 Vdc and with power at 120 Vac. Provide with 12 Vdc battery for 36 hours of operation (non-alarming). It shall have 8 digital inputs and 4 outputs plus a communications monitor. Provide fusing for the inputs that come from outside the panel and for the alarm beacon output. It shall be equipped with a modem for bi-directional communications over a dedicated line. Unit shall be Consolidated Electric E687, no equal.

#### **9-44.3.1 Operating Device Location**

- A. Operating devices shall be mounted no higher than 6' - 6" and no lower than 4' - 0" above finished floor when panel is installed unless otherwise approved by the Engineer. Indicating devices may be installed higher than 6' - 6".

#### **9-44.3.2 Installation**

- A. The power and control panel shall be installed by the Contractor or, at the option of the Contractor, by the manufacturer of the panel in accordance with the installation drawings and instructions prepared by the manufacturer. Installation shall be performed by workers who are skilled and experienced in the installation of electrical instrumentation and control systems.

- B. Installation shall include all elements and components of the panel and all interconnecting wiring between all equipment, components, and sensors. All wiring between cabinets, sensors and equipment shall be labeled at both ends for ease of servicing. All terminations shall be made with solderless pressure connectors. All wiring shall be in accordance with the plans. Intrinsically safe wiring shall be barriered per NEC requirements.
- C. Connection between the power and control panel and the existing telemetry equipment shall be included as indicated on the drawings and will be the responsibility of the Contractor.

#### **9-44.3.3 Inspection and Verification of Installation**

- A. After completion of the installation of the panel, the manufacturer shall inspect the installation and verify that all components and wiring are correctly installed. The manufacturer shall determine the exact scope and nature of work required to correct deficiencies and errors in the work and shall supervise the performance of such work.

#### **9-44.3.4 Calibration and Start-up**

- A. All components of the panel shall be calibrated by the manufacturer after completion of installation. Each component shall be adjusted to be within the required range and for the specific application. Components that cannot be properly calibrated or that are found to exceed the specified range or accuracy shall be removed and replaced.
- B. After completion of construction of the pump station, the panel shall be placed into operation by the manufacturer. Installation shall be performed by workers who are skilled and experienced in the installation of electrical instrumentation and control systems.
- C. The manufacturer of the power control panel shall be solely and completely responsible for all maintenance of the system from time of start-up to the date of acceptance, by formal action of the Owner, of all work under the contract. The manufacturer shall correct all deficiencies and defects and make any and all repairs, replacements, modifications, and adjustments as malfunctions or failures occur. The manufacturer shall perform all such work required or considered to be required by the owner to cause and maintain proper operation of the system and to properly maintain the systems.
- D. The Contractor and the manufacturer of the power control panel shall anticipate that the owner may delay acceptance of all work under the contract if, in the judgment of the owner, malfunctions or failures in operation of the panel occur after start-up. Both the Contractor and the manufacturer shall not be entitled to an

extension of time or to any claim for damages because of hindrances, delays or complications caused by or resulting from delay by the owner in accepting the work because of malfunctions or failures in operation of the panel.

#### **9-44.3.5 Operation and Maintenance Training**

- A. The manufacturer of the power control panel shall conduct specifically organized training sessions in operation and maintenance of the panel for personnel employed by the Owner. The training sessions shall be conducted to educate and train the personnel in maintenance and operation of all components of the panel. Training shall include, but not be limited to, the following:
1. Preventative maintenance procedures
  2. Trouble-shooting
  3. Calibration
  4. Testing
  5. Replacement of components
  6. Automatic mode operation
  7. Manual mode operation
- B. Two (2) separate training sessions, each at least two (2) hours in duration, shall be conducted at the pumpstation (after start-up of the system) concerning instruction and operation of the power and control panel, and all associated electrical equipment and devices. The manufacturer shall prepare and assemble specific instruction materials for each training session and shall supply such materials to the owner at least four (4) weeks prior to the time of the training.